2-15 June 1978 First and Third Friday Volume 144 Number 3586 40p

Model Engineer

MAP

(USA & CANADA —$1.75)

HOBBY MAGAZINE

Model Engineer

Founded 1898

Incorporating Mechanics, English Mechanics, and Ships and Ship Models

Volume 144 Number 3586
2 June 1978

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Second-class postage rates paid at New York, U.S.A. Registered at the Post Office for transmission by Canadian Post. American enquiries regarding news stand sales and advertising should be sent to MODEL ENGINEER, Eastern News Distributors Inc., 111 Eighth Avenue, New York, N.Y. 10011, U.S.A.

Enquiries regarding Hobby Shop Sales to Bill Dean Books Ltd., 166-41, Powell's Cove Boulevard, Whitestone, New York 11357, U.S.A. Telephone: (212) 767-6632.

Model & Allied Publications Ltd

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Heisler geared loco in ¾ in. scale, built and photographed by Kozo Hiraoka.

NEXT ISSUE

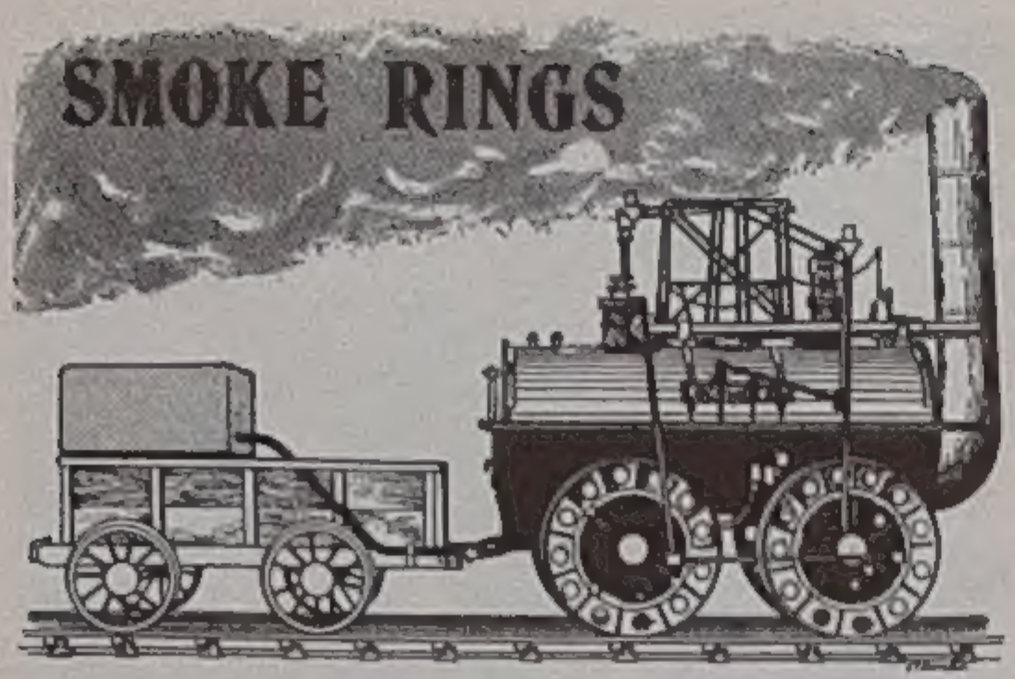
Alan Pickering's undertype wagon.

The Editor is pleased to consider contributions for publication in "Model Engineer". Manuscripts should be accompanied if possible by illustrations and should also have a stamped addressed envelope for their return if unsuitable. While every care is taken, no responsibility can be accepted for unsolicited manuscripts, photographs, art work, etc.

Subscription department:
Remittances to **Model & Allied Publications Ltd.**, P.O. Box 35, Hemel Hempstead, Herts. HP1 1EE (Subscription Queries Tel: 0442 51740). Subscription Rate £13.00, Overseas Sterling £13.00, U.S.A. and Canada $25.00, 1st Class Airmail $64.00. Annual Subscription includes a copy of the Model Engineer Exhibition Guide published in mid-December and the Annual Index.

Model Engineer is printed in Great Britain by Blackfriars Press Ltd., Leicester, for the proprietors and publishers, Model & Allied Publications Ltd. (a member of the Argus Press Group), 13/35 Bridge Street, Hemel Hempstead, Herts. Trade sales by Argus Distribution Ltd., 12/18 Paul Street, London, E.C.2, to whom all trade enquiries should be addressed.

M.E. QUERY COUPON JUNE 1978



A Commentary by the Editor

Remembering John Fowler

The Steam Plough Works of John Fowler & Co. Ltd. opened in 1861 and closed in December 1973. In the time they were open, the works produced thousands of road and rail locos, a fact which is no doubt already known and appreciated by *M.E.*'s readers. Now the works have gone from the corner of Leathley Road and Hunslet Road in Leeds and their place will be taken by a new building, the printing works of E. J. Arnold & Son Ltd. This company has kindly agreed to allow Leeds & District Traction Engine Club to erect adjacent to the works a memorial to the old John Fowler company. The cost of this is going to be £3000 which has to be raised by appeal. I am sure that many readers will wish to help this venture and should, therefore, contact the Fund Treasurer, Mr. M. Clark, 4 Wedgewood Grove, Leeds, LS8 1EG.

British Locomotive Catalogue 1825-1923

Volume Two of the British Locomotive Catalogue, referring to L.N.W.R. and associated locos, has been somewhat delayed through the "complexities of L.N.W.R.'s numbering systems", Moorland Publishing Company tells us. As the book is also an additional length it will be issued in two parts, the first being ready, it is hoped, by the end of this summer. Further volumes should be along at intervals of six to nine months. The publishers wish to apologise to subscribers and trade customers for the delay but can assure them that the whole series will appear as promised.

Wee Scot pumps

If you missed the announcement in the last issue of *M.E.* about the Wee Scot MK Zero Pump you will want to know about it. The supplier, Scot Urquhart, has asked us to inform recent purchasers of this pump that to make the unit function safely and correctly a small modification may be required. You can check by phoning Mr. G. Urquhart on 01-874 5708.

Stuart Turner increase stores

Over one million spare parts are now in stock at Stuart Turner Ltd. and the storage capacity of their Henley building has been increased by streamlining. The company states that interest in their models and in model engineering generally is growing world-wide. This is also reflected in the membership of Stuart International Model Engineers Club (SIMEC) which has grown to more than 700 members made up from over 30 countries. Last year's SIMEC exhibition attracted in excess of 150 visitors for the first time ever and sales for 1977 were up on 1976 by one-third.

Free film for life

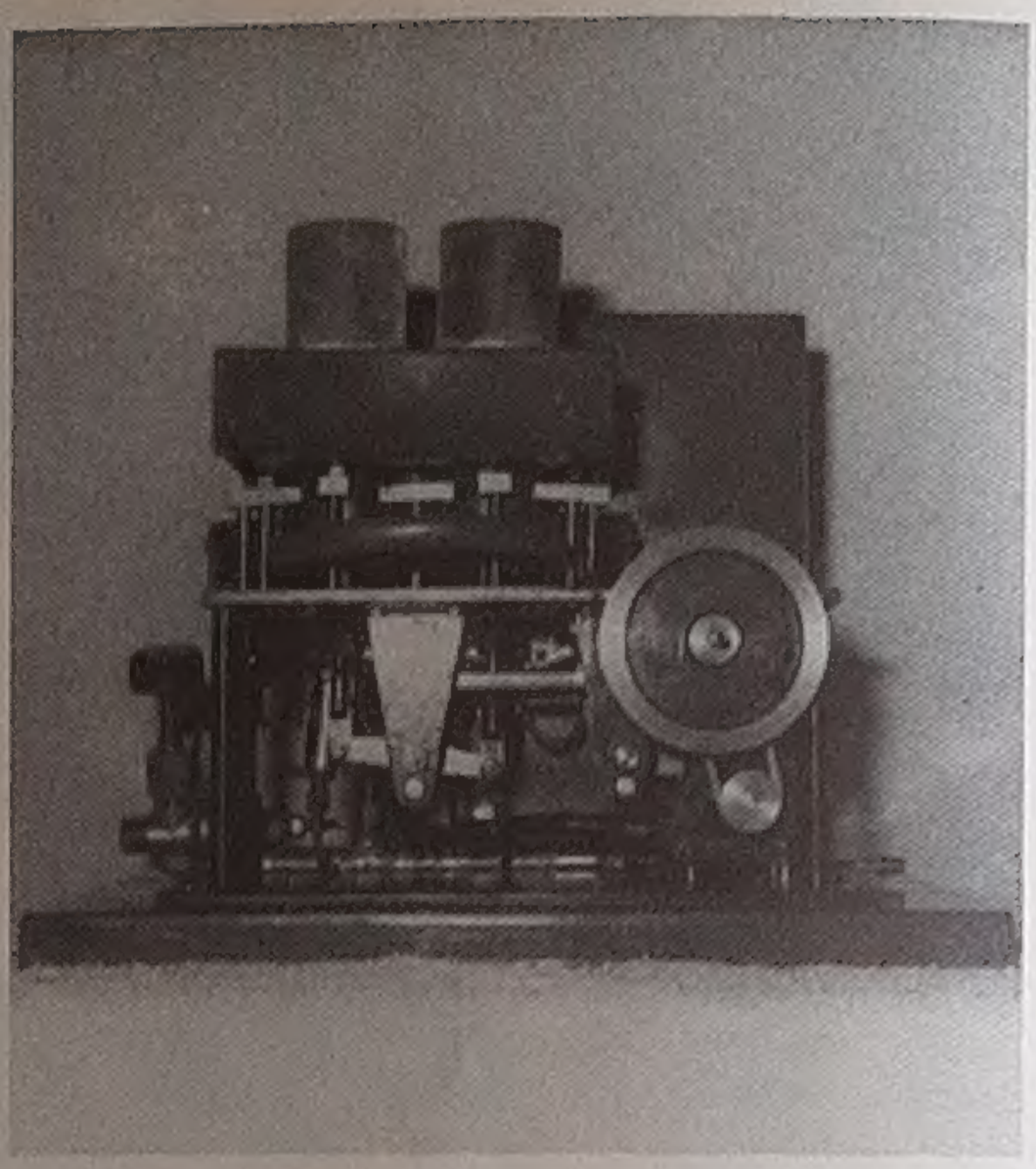
The humble amateur snapshot is coming into its own as a collector's item, a mirror of social history — and now the subject of a competition, entitled *All Your Yesterdays*, due to be launched in the July issue of Photography, on sale from Friday June 16. The top prize, donated by Kodak Ltd., is a free supply of film to the value of £25 each year for the entire life of the winning contestant — plus a Carousel slide projector to be delivered at Christmas 1978. Additionally, there are cash prizes totalling £250, donated by Model & Allied Publications Ltd. The contest is open to photographs taken during the period 1888 to 1938; that is the fifty years following the appearance of the first roll film box camera. The outright winner may be chosen from any one of six categories — People, Holidays, Transport, War, Street Scenes and Special Occasions — and there is a cash prize of £50 for the best picture submitted in each of the other five categories. The competition is the first of its kind ever organised by a photographic magazine and is expected to attract entries from many people who do not normally enter photo contests. The closing date is September 1 and the results will be published in *Photography* later this year. For further information contact Tony Rose on Hemel Hempstead (0442) 41229.

Home workshop

By the time this issue appears on the book shelves, the new one-off magazine "Setting up a Home Workshop" will have been published. I have just seen a pre-publication sample and I consider it the very book to help those readers who write to us from time to time requesting information on the design and equipment required for a new workshop. This, of course, applies mainly to the comparative beginners or for those who are expanding their range of equipment. The magazine which costs 60p contains such chapters as the layout, lighting and heating, storage, types of tools, tool sharpening and various other relevant items.

5 cc.
HOT AIR ENGINE
(Double Acting)

by F. R. Wilkinson



I WAS DELIGHTED to find that I had won the Competition 1978 for Hot Air Engines, though disappointed that there were so few entries. My engine produced just over seven watts, which was quite an improvement over my last year's entry. The Competition's new set of Rules and Regulations seemed difficult at first, but to me they sorted themselves out, as I built up my new model. First, if the engine was to be pressurised to 100 p.s.i. then the construction must be stronger and be capable of withstanding a high internal pressure — but how high?

I decided to start by setting myself a target power output of ten watts. From my Low's pocket book for Mechanical Engineers, I extracted two formulae dealing with pressure engines and found the following:

$$\text{I.H.P.} = \frac{\text{PLAN}}{33{,}000}$$

I.H.P. = Indicated H.P. (power at piston) or $\frac{\text{Watts}}{746}$

P = mean pressure on piston — p.s.i.

L = stroke of piston in feet

A = Area of piston in square inches

N = Number of strokes per minute (double acting, twice the revolutions of the crank).

Using 10 watts and speed 1000 r.p.m., I obtained a mean pressure of 17 p.s.i. on the piston. The peak pressure (I obtained by doubling the mean) gives 34. Mechanical Efficiency was taken as 75 per cent — 45 p.s.i.

Now applying this pressure to the gas law for constant volume

$$\frac{P1}{P2} = \frac{1 + Ct_1}{1 + Ct_2}$$

C is constant at .002, P1 initial pressure 100 + 15 p.s.i. absolute, P2 new pressure 115 + 45 p.s.i. absolute, T1 temperature of gas at start say 72°F. – 32°F. = 40°F., T2 to be calculated (+ 32°F.).

This gives an answer of 284°F. which seems very low, when the temperature of the "hot ends" must be above 500°F.

Let's apply a temperature of 502°F. into the gas law formulae. P1 – 115 p.s.i. absolute, P2 unknown, T1 – 40°F., T2 502°F. – 32°F. = 470°F.

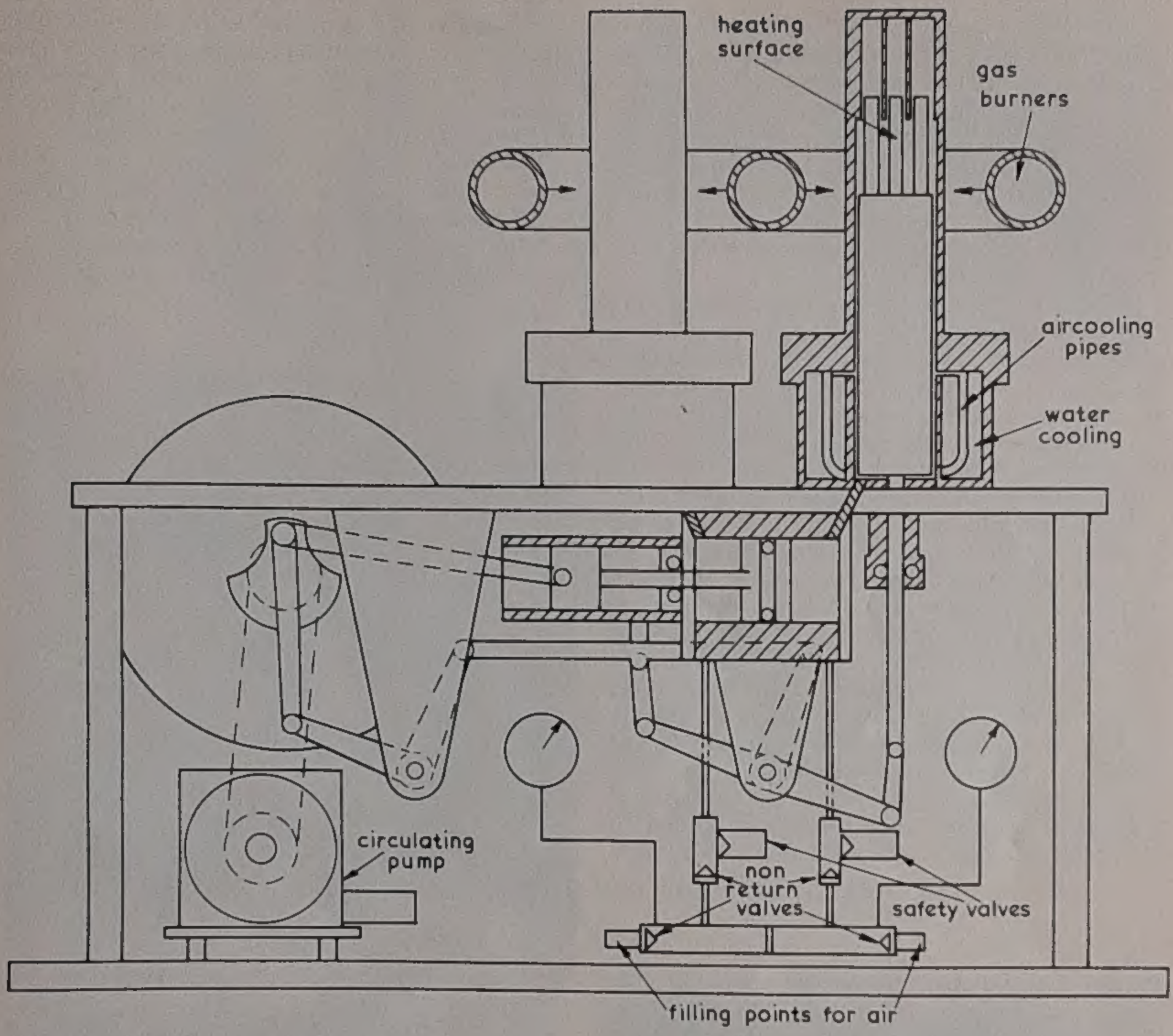
This gives a pressure of 206 p.s.i. absolute or gauge pressure of 191. Taking away initial pressure of 100 gives 91, convert to mean pressure,

$$\frac{91}{2} = 45$$

at mechanical efficiency 75 per cent = 34 p.s.i.

Inject this into the I.H.P. formulae and the power output would be 20 watts. These calculations can only be taken as a guide, but they do show that there is plenty of room for better design and also what the peak pressure could reach. I decided my safety valves should lift at 210 p.s.i. with a test pressure on the plant of 420 p.s.i.

The rule asking for the engine to hold its internal pressure for at least one hour before testing, or to provide its own compressor driven by the engine to maintain its pressure, looked difficult. I did not like the idea of the compressor — could use too much power. I was left with "having a go" at making the engine really airtight. All of the glands would be sealed with "O" rings of the white silicone rubber



type. They can provide tight, low friction seals. Good fitting is a necessity.

The engine was built as a double acting 5 cc. machine — 2.5 cc. each side of the piston. The displacers were also made to move 2.5 cc. of air (instead of the usual 1½ times the volume covered by the power piston). This was decided for two reasons. First, with pressurisation, the work done moving the displacers would greatly increase. Second, the "Rombic" drive engines which have this feature are very successful. Water cooling was increased by fitting a circulating pump belt driven from the main engine shaft. It was centrifugal in design with 1¼ in. dia. impeller. Also ten 3/32 in. dia. copper pipes were fitted in the water cooling chamber to increase the cooling effect on the working gas.

The running results were very disappointing. The engine would not even run at atmospheric pressure. However, building up the internal pressure to:

20 p.s.i. no load — 800 r.p.m. were reached.
30 p.s.i. no load — 1200 r.p.m.
40 p.s.i. no load — 1220 r.p.m.
50 p.s.i. no load — 1200 r.p.m.

Maximum load 0.95 watts at 800 r.p.m. was achieved.

Having overcome the desire to throw the whole thing on the scrap heap, I realised that the external heat applied was not reaching the gas inside the engine in sufficient quantity. There was a lack of heating surface.

I did not consider that converting the displacers into heat exchangers would be the answer as this would also lower the compression ratio and could reduce the power output. How to break up the air circulation into very small streams was the problem. This could be done by fitting many fine bore tubes, but, from a practical aspect, would be difficult. Extra surface area was required. Thinking about this after I had retired to bed one night, the idea occurred to me to fit as many small round rods to the heated ends of the displacer pistons as possi-

ble, and these to enter clearance holes drilled into the extended tops of the chambers. Following up the idea I worked out areas.

Seven ⅛ in. dia. rods, 0.75 in. long could be fitted to the top of each piston and seven holes. 5/32 in. dia. could be drilled. This gave an added surface area of 4.62 sq. in. Original area was 2.69 sq. in.

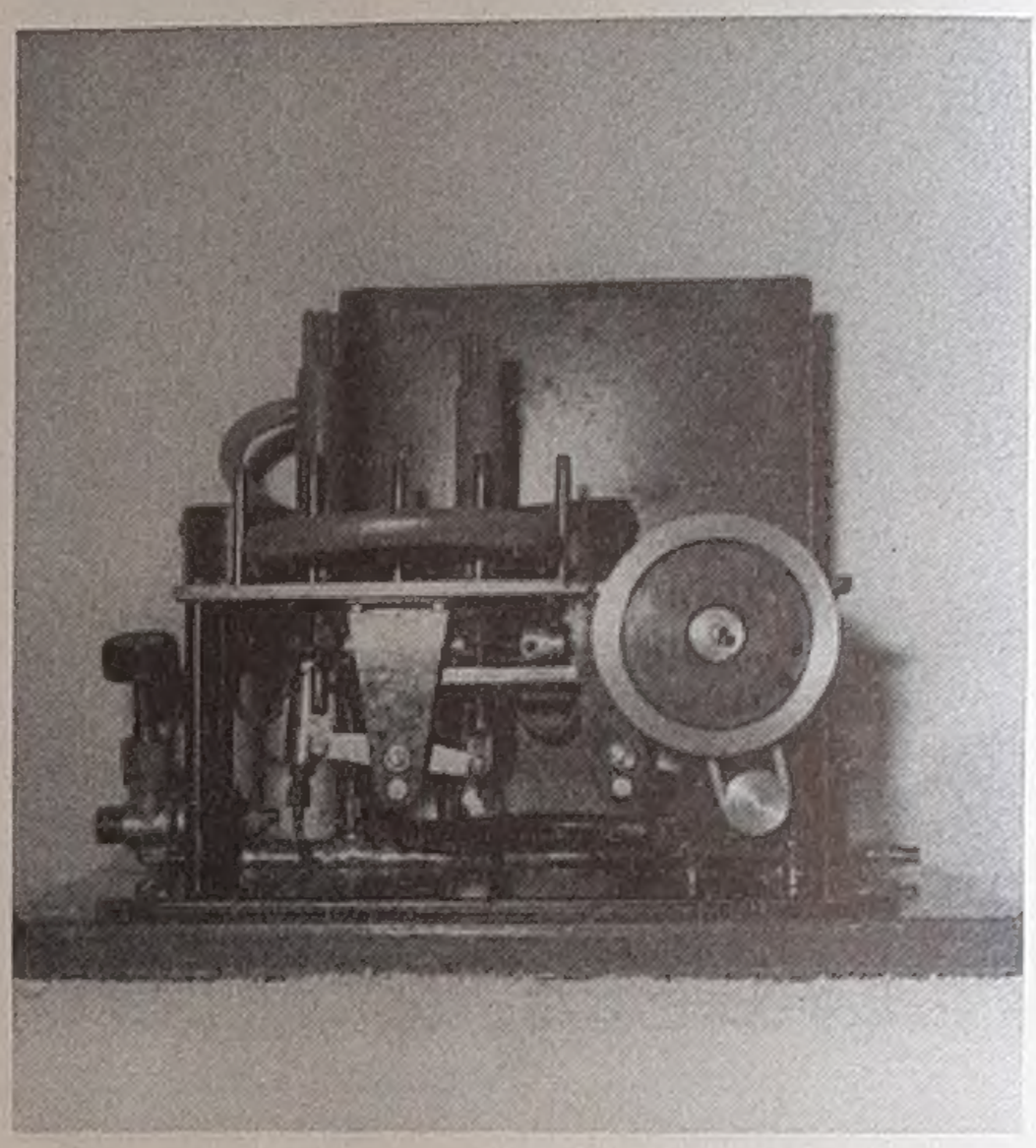
This idea was put into effect. A screwed brass rod, 5 BA, was used, as the thread would give added surface as well as turbulence. The running results were very much better and a finally reached a load of 8 watts at 90 p.s.i. internal pressure and a speed of 1125 r.p.m.

By now 1 December was fast approaching and I decided to be satisfied for the time being and complete the engine. The rules called for a pressure test which was carried out at 420 p.s.i. using water at the medium, a witness signed a certificate to this fact. Safety valves were built, bearing in mind that leakproof valves were required. I used "O" rings for the seats and the valves set to lift at 210 p.s.i.

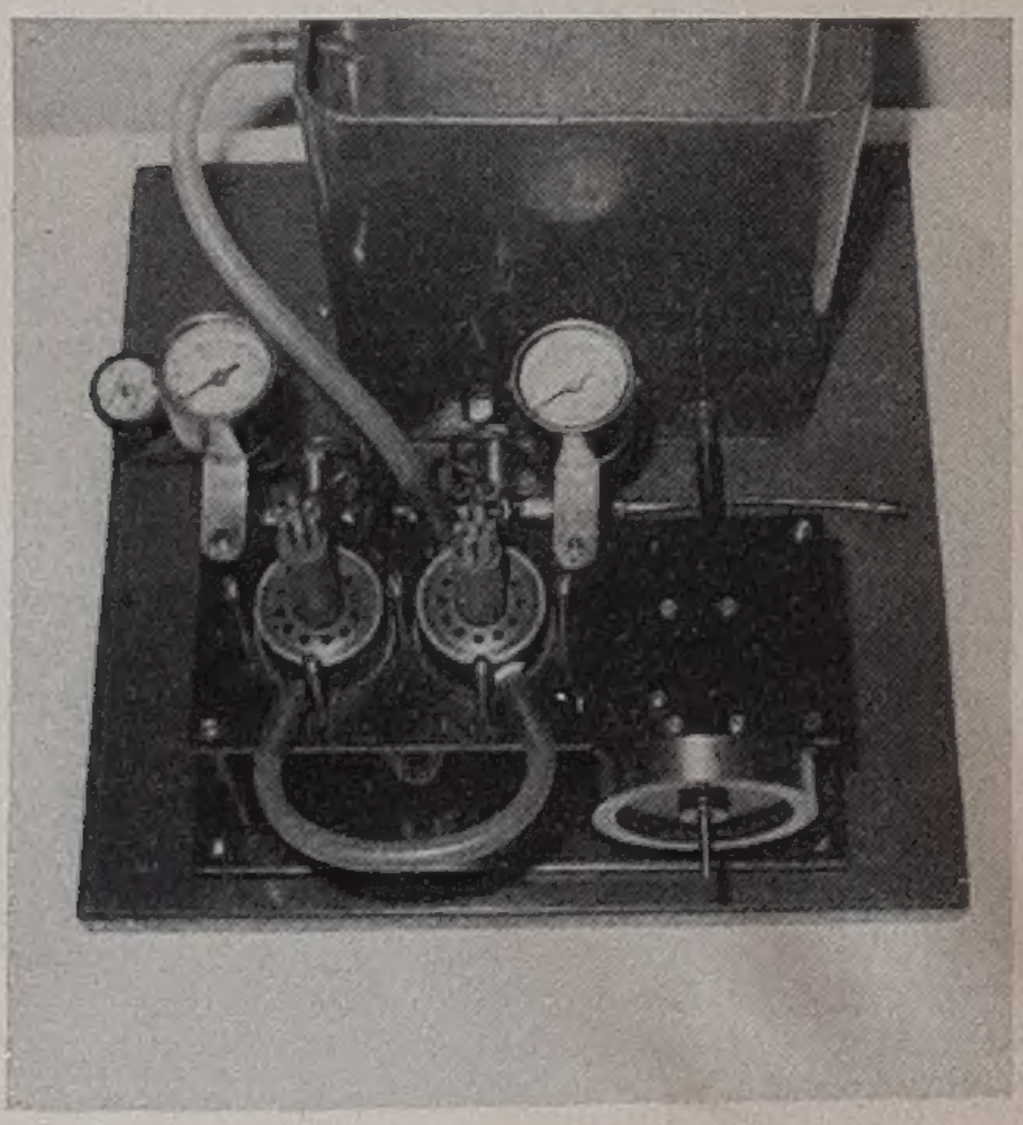
A pressure gauge was called for to show internal pressure but the gauges could not be connected direct to the engine because of pressure variation. As there are no balance chambers, I had to provide one for each side of the piston and this required two non-return valves to each chamber. Again, I used "O" rings with very light springs to keep the valves on their seats. The air pump was made from a length of ⅜ in. I.D. brass tube with an "O" ring on the piston. Stroke is about 6 inches.

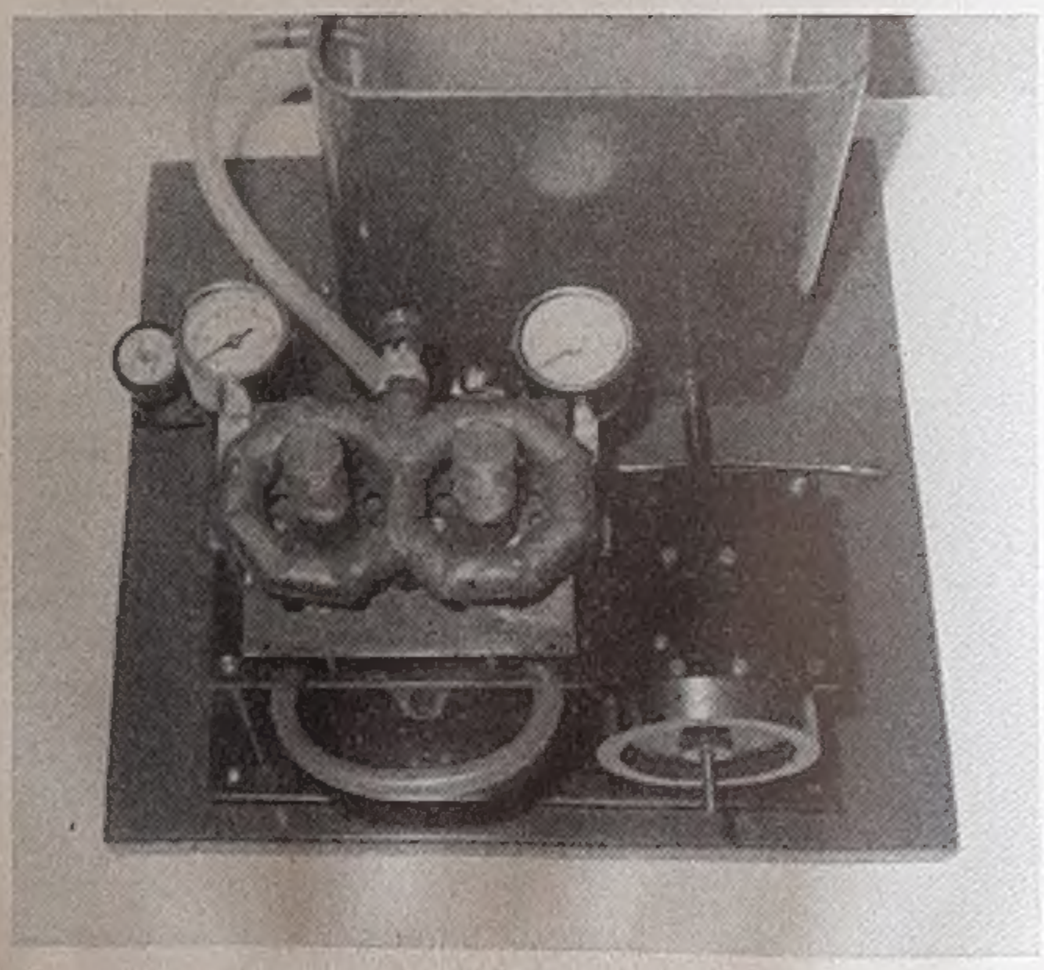
Just a word about lubrication. As all the bearings are outside the pressure areas, this presented no real problem. I used ball bearings for the main shaft with hardened silver steel bushes at the other points. However, the piston and its "O" ring are in the pressure area, which must have some lubricant. The ring groove was packed with an anti-scruffing grease before assembling and was found to have been given sufficient lubrication, when opened up some running hours later. The drawing shows some details of the various parts I have mentioned.

This competition has proved to be a real challenge and has given me great satisfaction to overcome the difficulties. I send my thanks to Mr. A. N. Clark, and also to Professor Chaddock for the interest he showed in carrying out the trials.

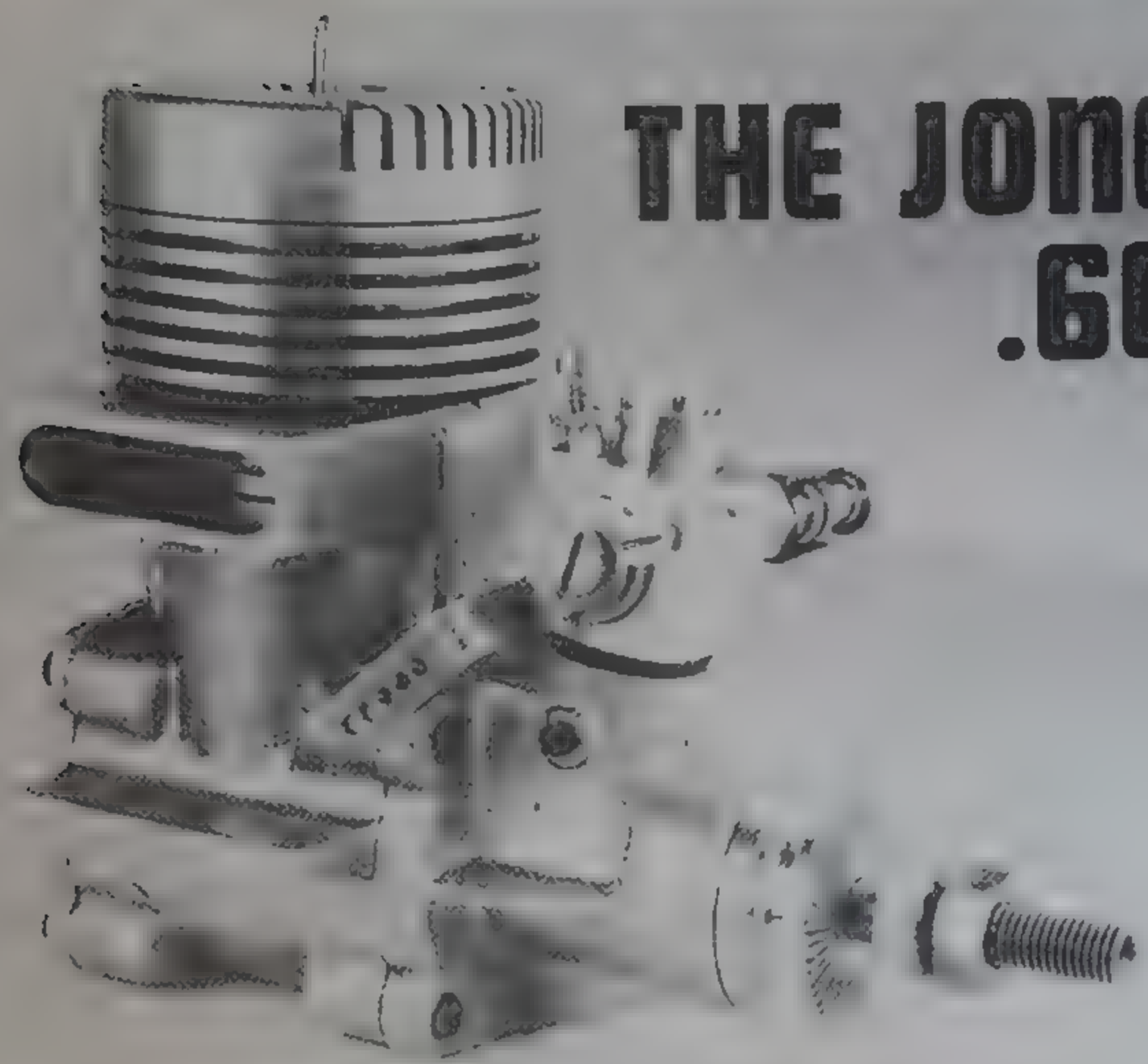


Heating surface is plainly visible here.





Top — gas burners and displacer covers removed.
Bottom — burners with flame shield removed.



THE JONES .605

Colin Jones concludes the description of his 10 cc. glow plug motor

Part III

From page 569

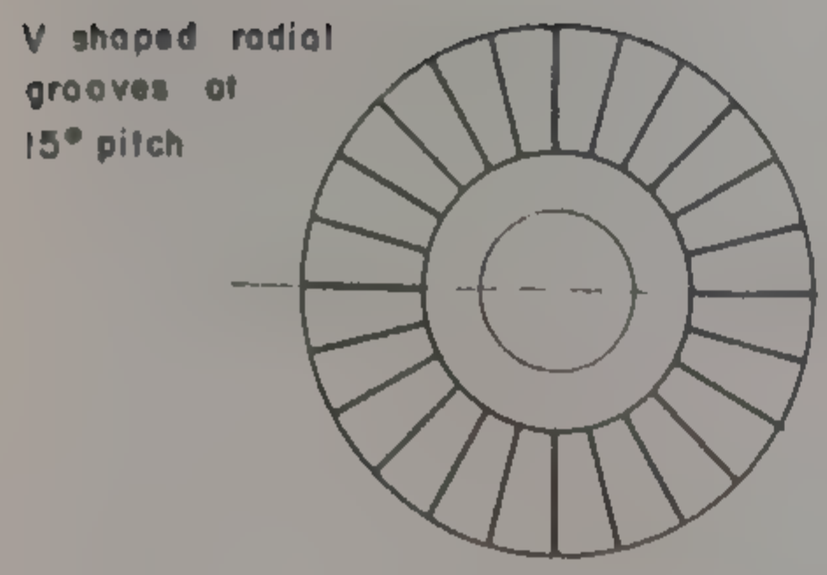
THE PROP. DRIVER is turned from a piece of aluminium bar. This is a straightforward item to make, the only thing to be careful with is the 10° inclusive taper, if possible the associated brass collet taper should be cut without disturbing the top slide to ensure that they match. The collet, when finished, should be slit using the balsa saw again. The front of the prop. driver is marked with radial grooves about 1/32 in. deep, there should be about 20-30 equally spaced around the driver. To do this I hold the prop. driver in the chuck and using the change wheels I index the chuck by wedging one tooth at a time with a piece of flat steel. A sharp tool is held in the tool post and adjusted so that it will take about 1/32 in. cut off the face, then at each increment it is moved across the face by the cross slide, thus producing a groove. The grooves are necessary, as they provide a good friction contact against the propeller. A washer is now made from aluminium and this completes the components for the engine itself.

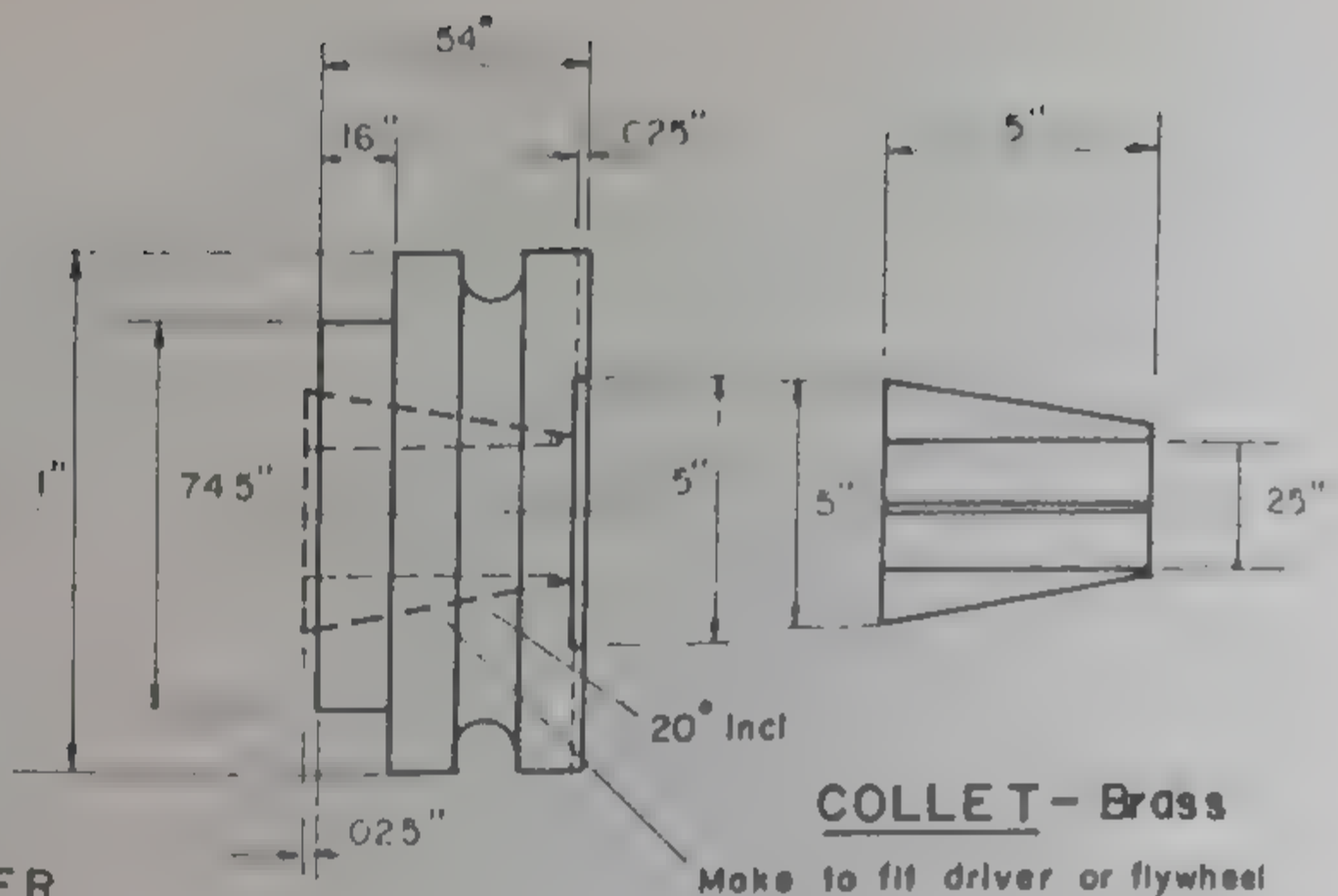
Flywheel

The flywheel is made from b.m.s., brass or any other suitable material. It is first held in the three-jaw chuck and the rear face machined, it will be necessary to grind a narrow tool to get into the recess. A ¼ in. dia. hole is drilled through the flywheel and the 10° taper is turned (20° inclusive). The flywheel is then reversed in the chuck and it is turned to length + about 10 thou, and the recess is bored leaving it a bit undersize, don't worry about concentricity at the moment as this will be dealt with later. It is now removed from the chuck and mounted on a spigot. I used a piece of ½ in. round bar for the spigot; it is first drilled and tapped to ¼ in. BSF about ½ in. deep, then the 10° taper is turned to take the flywheel. The flywheel is now held on the spigot with a ¼ in. BSF bolt and the outside turned to size, the starting groove is turned and the recess at the front trued up. This ensures absolute concentricity when mounted to the motor using the collet as previously explained

The carburettor

The carburettor is made from ⅞ in. square alloy bar, I have used ¾ in. square bars, but things are then a bit tight for room. Firstly mark out for the

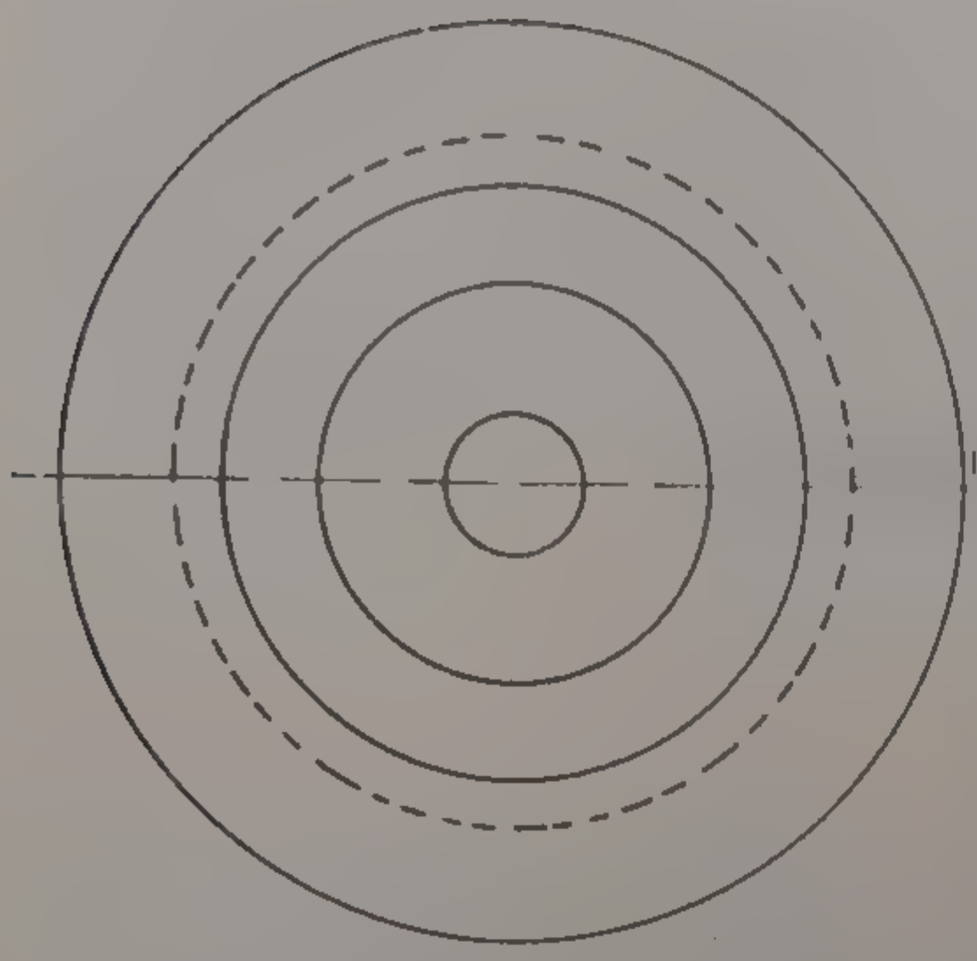


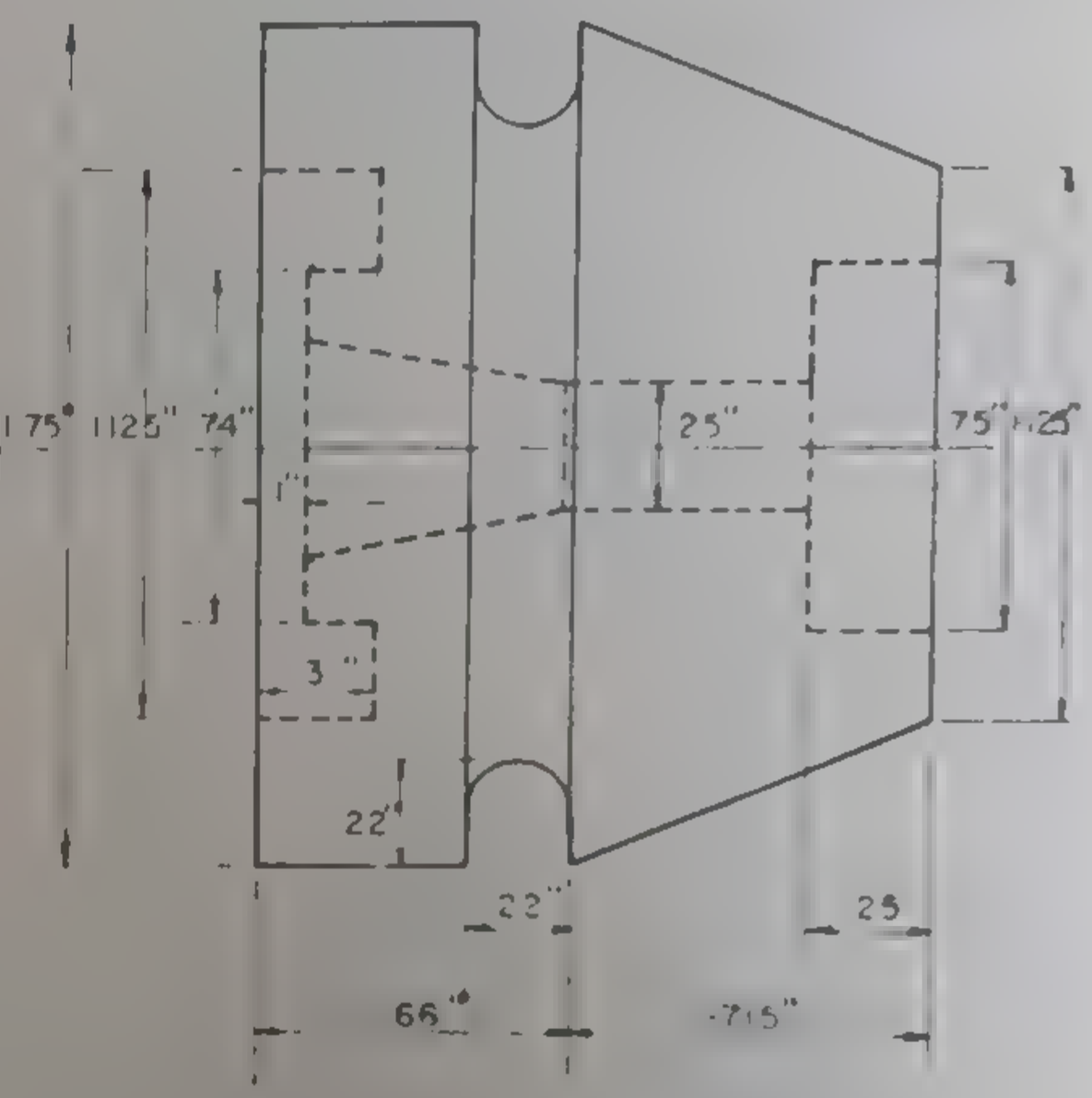


PROP DRIVER
Aluminium

COLLET – Brass

Make to fit driver or flywheel as dotted outline

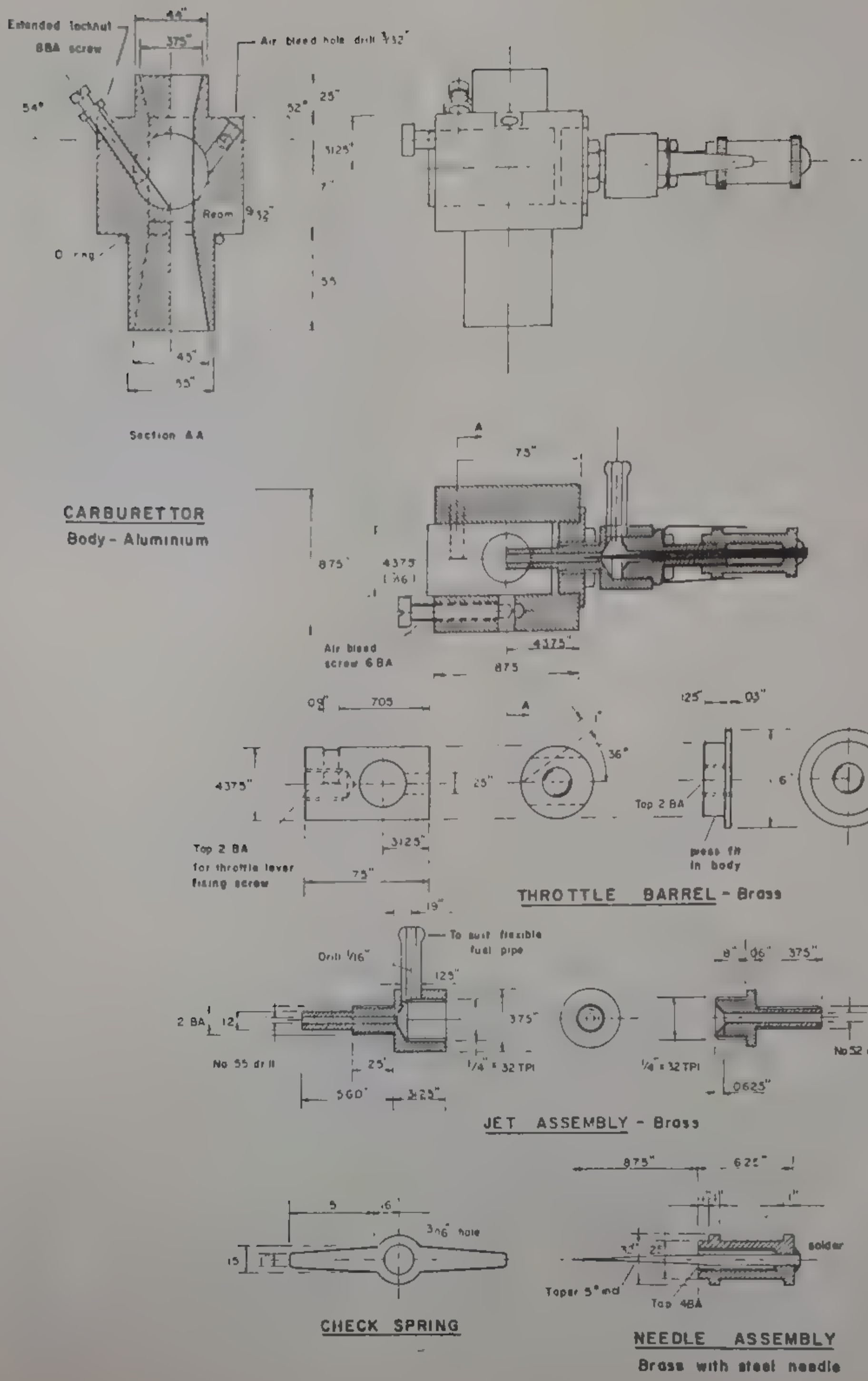




FLYWHEEL

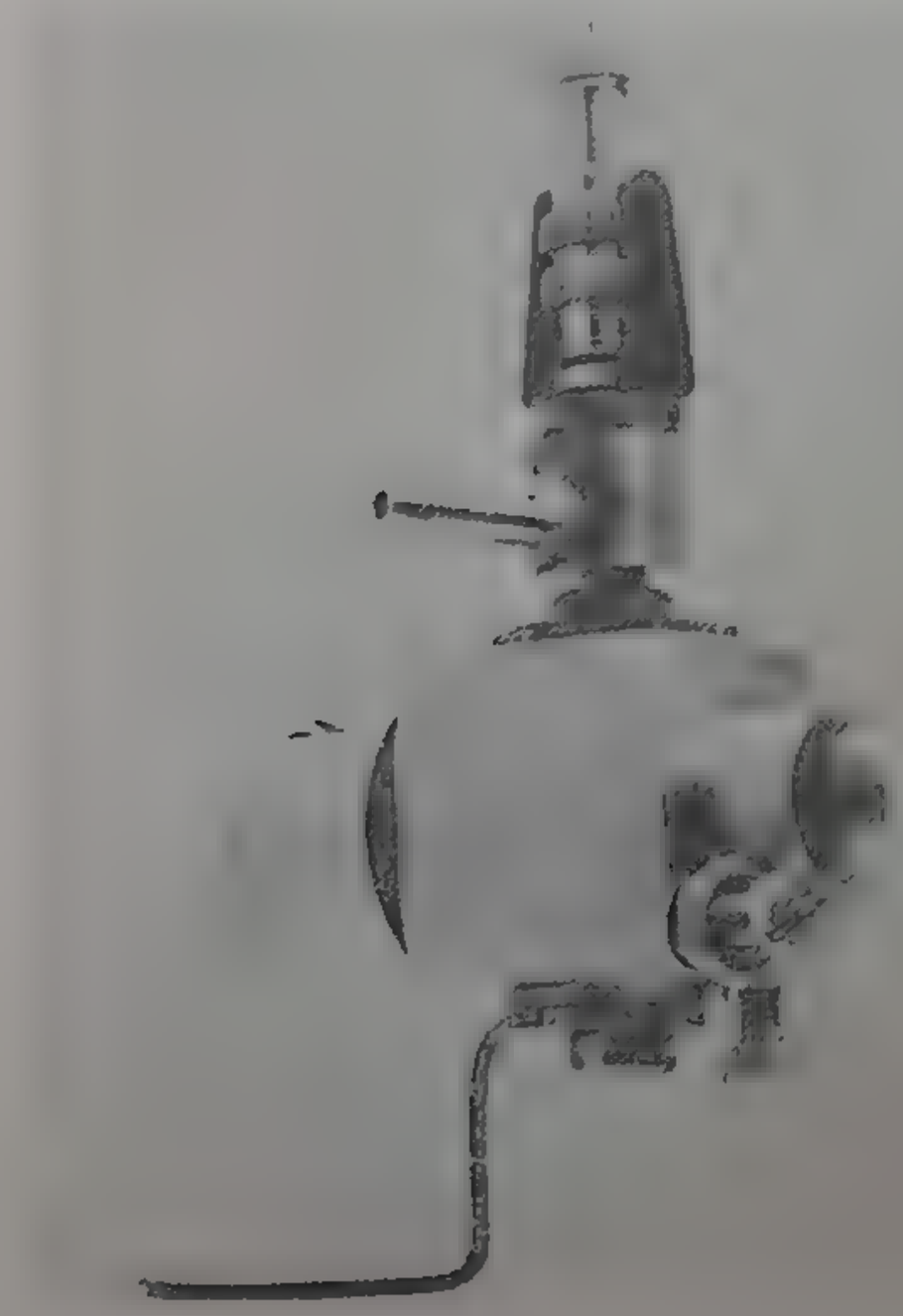
Brass, Steel or C.I.

central hole and the throttle barrel, bearing in mind that when inserted in the chuck the top of the carburettor will be facing the chuck. Now drill and ream the throttle barrel hole making sure that it is truly through the centre, then mount the bar in the four-jaw chuck, line it up and drill the central hole finishing with a 9/32 in. reamer. Machine the mounting stub and flare out the central hole so that it will blend with the intake port in the front housing, the angle of taper is not critical. The intake boss is done next with a narrow tool, such as a parting tool, and it is then parted off. To produce the intake choke taper it is held by the mounting stub in the three-jaw, and centred as near as possible. The slow running jet is drilled, its position being not too critical but it should be uncovered by the throttle barrel at about half throttle. The 6 BA jet screw hole is drilled and tapped so that it enters the slow running air-bleed hole. The hole for the throttle stop screw is drilled and tapped, again position and angle are not too critical as the barrel is made to match. The screw will cut across the throttle barrel by 1/8-3/32 inch. The throttle barrel is made from brass and should be a good running fit into the carburettor body. The 9/32 in. hole should be exactly central through the barrel or else difficulty will be experienced in blending it with the choke. It is now inserted into the barrel and the position of the slot marked from the throttle stop screw and the slot cut with a slitting saw or other suitable means.


Extended locknut
BBA screw
Air bleed hole drill 1/32"
54°
52°
25"
3125"
7"
55
Ream
9/32"
O ring
45"
55"
Section AA
CARBURETTOR
Body - Aluminium
875"
4375"
(7/16)
Air bleed
screw 6BA
4375"
875"
A
75"
09"
705
4375"
3125"
75"
19"
Top 2 BA
for throttle lever
fixing screw
A
1°
36°
25"
125"
03"
Top 2 BA
press fit
in body
6"
THROTTLE BARREL - Brass
Drill 1/16"
To suit flexible
fuel pipe
125"
2 BA
12"
375"
No 55 drill
25"
1/4" x 32 TPI
560"
322"
8"
06"
375"
4 BA
No 52 drill
1/4" x 32 TPI
0625"
JET ASSEMBLY - Brass
5
16"
3/16" hole
15
CHECK SPRING
875"
625"
1"
solder
Taper 5° end
Tap 4BA
NEEDLE ASSEMBLY
Brass with steel needle

The part for holding the jet assembly is made from brass and is made 1-1½ thou bigger than the barrel, it is inserted by gently heating the carburettor body and then pushing it in. The jet assembly is fairly straightforward. A piece of ⅜ in. dia. brass bar is held in the chuck and the jet tube machined to size, the 2 BA thread made, and the No. 55 hole drilled. It is then parted off and reversed in the chuck and the hole drilled and tapped to accept the needle-valve assembly. The nipple is made and soldered into the jet assembly, for those who would rather buy the needle assembly, it is available from most model shops, and is an OS.45-.60 spare. There are other needle valve assemblies on the market which will fit directly into the carburettor, but special taps will have to be made to replace the 2 BA tapped hole as most spares have a fine metric thread. When all parts are finished the barrel is inserted into the carburettor and located by the throttle stop screw, and the alignment of the hole in the barrel is checked against the hole in the carburettor, should it be only slightly out a 9/32 in. reamer can be passed through the whole assembly thus blending the passage at the full throttle position. The jet assembly is inserted until the tube is approximately half-way across the hole in the throttle barrel and the nipple is facing to the rear. The slow running jet screw and throttle stop screw are prevented from turning by the use of lock nuts or springs.

The carburettor assembly.



Propeller driver mounted on crankshaft.

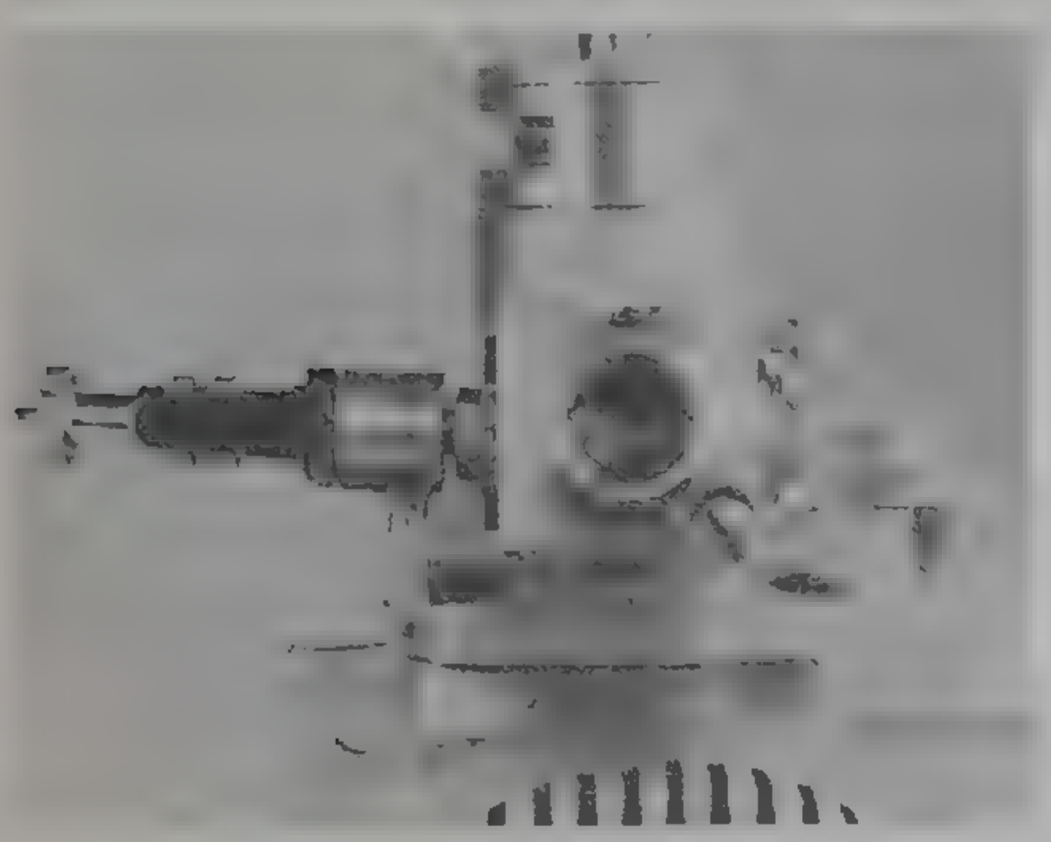
Assembly

Before assembly all parts will have to be checked for fit etc., and that they are free from dirt, swarf and other harmful material. I usually boil all parts in a saucepan (borrowed when the wife's out) using a small amount of detergent. This removes all dirt, especially the remains of any grinding paste from the lapping of the cylinder liner. When removed from the water the iron and steel parts should be oiled to prevent rusting, oil is also used during assembly on all bearings and rubbing parts.

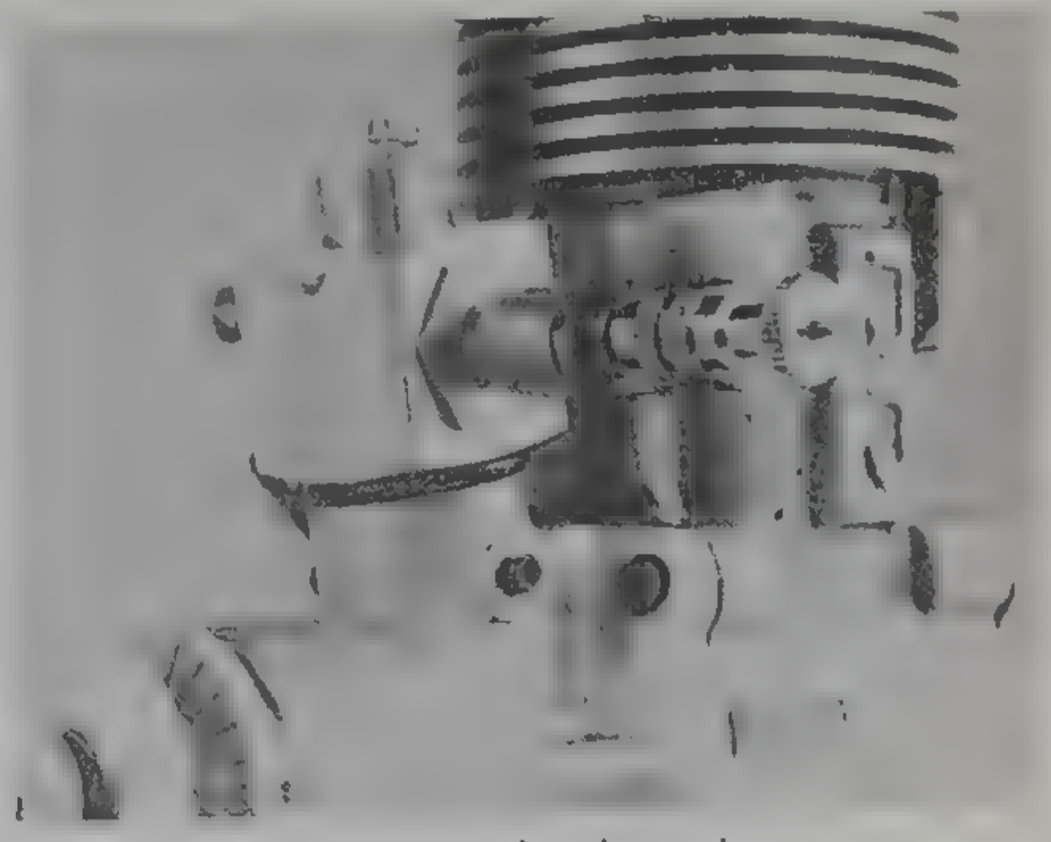
Firstly, insert the bearings into the front housing and then push in the crankshaft. The crankshaft should rotate freely and not bind at all, if it does any high spots in the journal can be eased with fine emery paper, but don't forget to remove all traces of grit. Now put on the collet and prop. driver and bolt them up using a spacer or a propeller on the shaft. The prop driver should be just clear of the front housing and not bind. The crankshaft should still be free to rotate, if not find out why and remedy.

Insert the liner into the main casting, ensuring that the ports line up, then insert the piston assembly complete with con-rod, gudgeon pin and ring, into the liner again paying attention to the port orientation. Now insert the front housing into the main casting at the same time locating the big end pin into the con-rod, don't forget the thin paper gaskets. The cooling jacket is fitted followed by the cylinder head. Shim steel spacers should be used for the head and they should be adjusted so that the piston to head clearance is about 10 thou. Finally the backplate is fitted and the carburettor added, but don't forget the rubber "O" ring, this is very

important for sealing. The engine should now rotate without any signs of binding, the only resistance being felt on the down stroke when the air in the crankcase is being compressed by the piston, and a small "phut" should be heard as the ports open. The plug is a 2 volt long reach type and when fitted the engine should have quite a good compression.



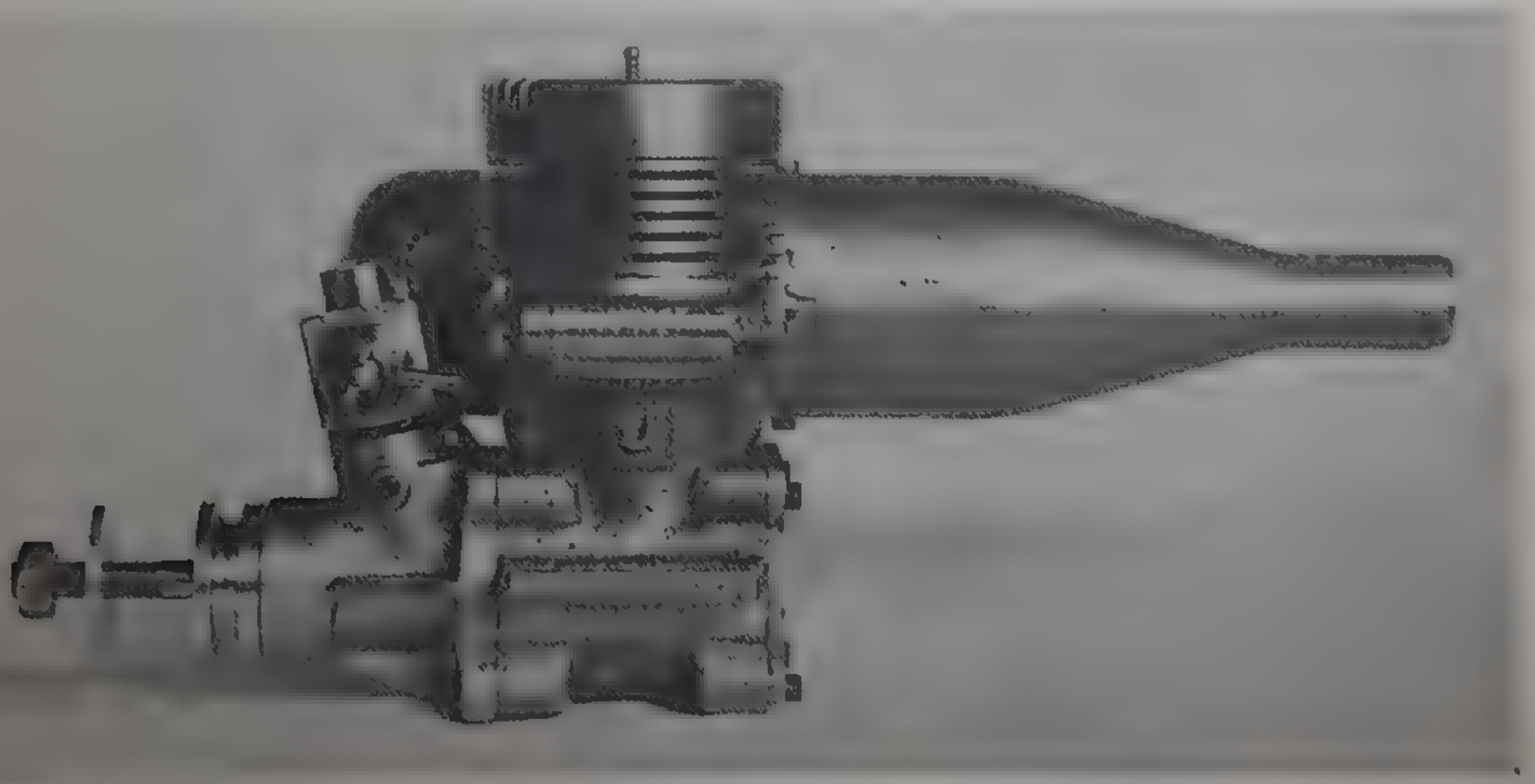
Top view of carburettor installation.



View showing "O" ring seal under carb.

For experimental running, the engine should be mounted firmly by the mounting lugs in some sort of jig or stand, and a fuel tank of about 10-20 cc. mounted nearby the centre line of which is about the same height as the jet in the carburettor. The fuel used is standard or 5 per cent nitro glow fuel, or for those who wish to mix their own, 20 per cent castor oil and 8 per cent methanol. An 11 in. x 6 in. propeller is used for running in. The engine is primed with fuel until it sounds nice and juicy, but don't over do it, the needle valve is opened 2-3 turns, and the glow plug is connected to the battery. A few smart flicks on the propeller should produce some results. With an engine this size it is a very good idea to wear a leather glove or "chicken finger" for starting. When started the throttle is opened and the needle valve adjusted until the engine is not quite two-stroking. It is run in at this rich setting for about 1-2 hours, then gradually leaned out until it will run at peak revs. without showing signs of slowing or overheating. Now is the time to adjust the slow running jet and throttle stop.

For the peak of performance the cylinder head shims can be adjusted to give maximum r.p.m. on which every propeller is to be used. I use 11 in. x 8½ in. props. and the peak of performance was obtained with a squish band clearance of 7½ thou, but engines will vary. During all engine running it is a good idea to fit a silencer to the engine as two-stroke engines are very noisy. I am experimenting with a silencer at the moment.



THE MARSHALL PORTABLE ENGINE

Part XII

by Ron Kibbey

Continued from page 512

THE GENERAL LAYOUT of the hind axle beam is not at all clear from the G.A. printed at the beginning of these articles and, it was not until Bill provided me with a sketch, that I was able to proceed.

It is of "U" shape, wrapping round and running along the forward wall of the firebox, and being bolted to the underside of two mild steel angle plates which are fastened to the firebox wrapper sides through the hollow stays provided.

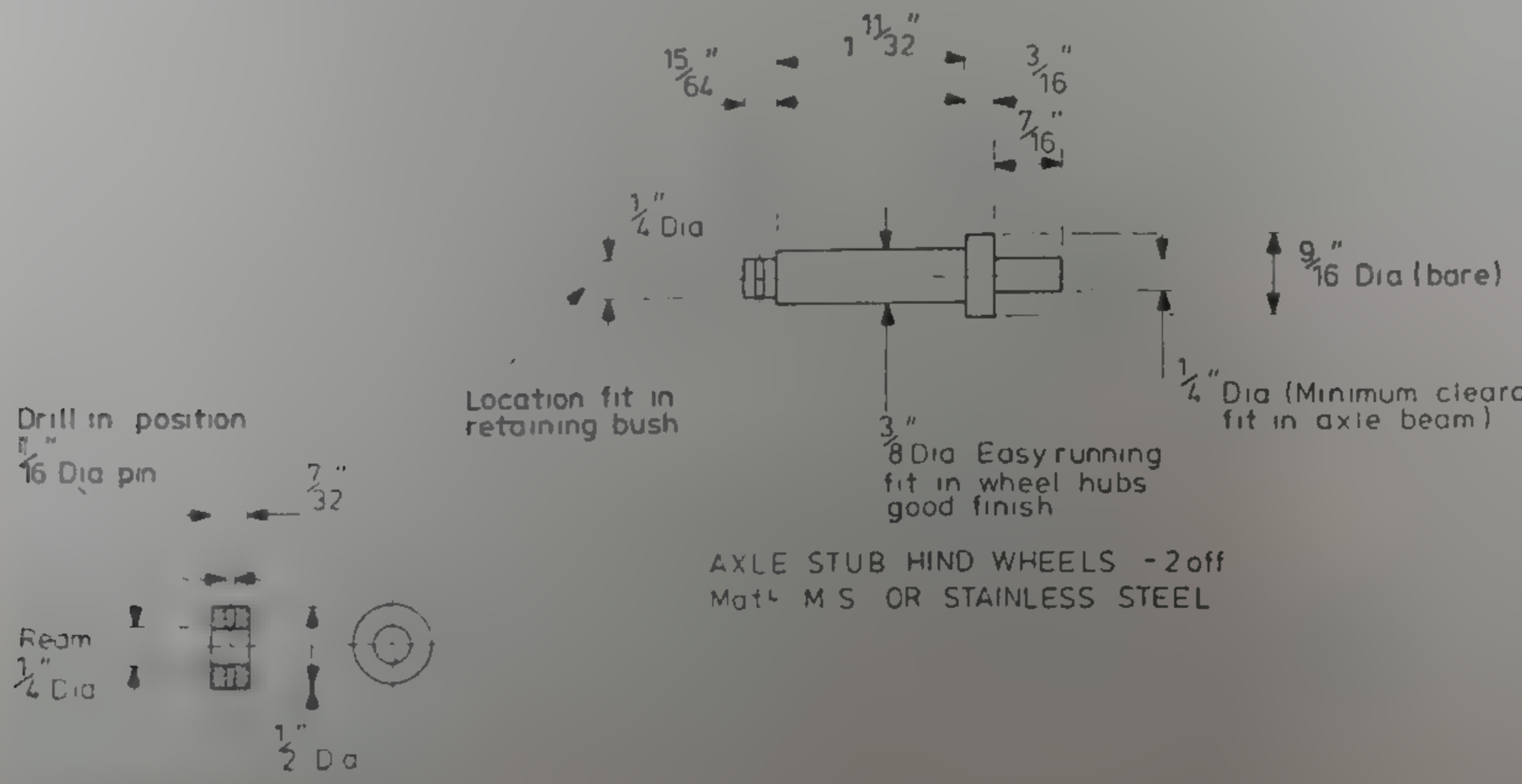
Reeves are making available these axle beams as malleable iron castings, which are being cast pretty well to size, requiring machining only on the stub axle boss faces and truing up of the upper faces of the beam to make a flat seating on the angle plates. The angle plates will have to be machined from square bar or larger section angle, since no commercial angle of this section is obtainable. The stub axles fit in the ends of the beam, the holes being drilled and reamered at an angle of 3° from the horizontal. I have called for these stubs to be Loctited in position before drilling the two vertical bolt holes. At the time I built my model no castings were available and I produced the beam by bending some ⅜ in. square black bar. This meant milling 1/16 in. from the front edge and blending in the 9/16 in. rad. by filing. Some builders may prefer to use this method.

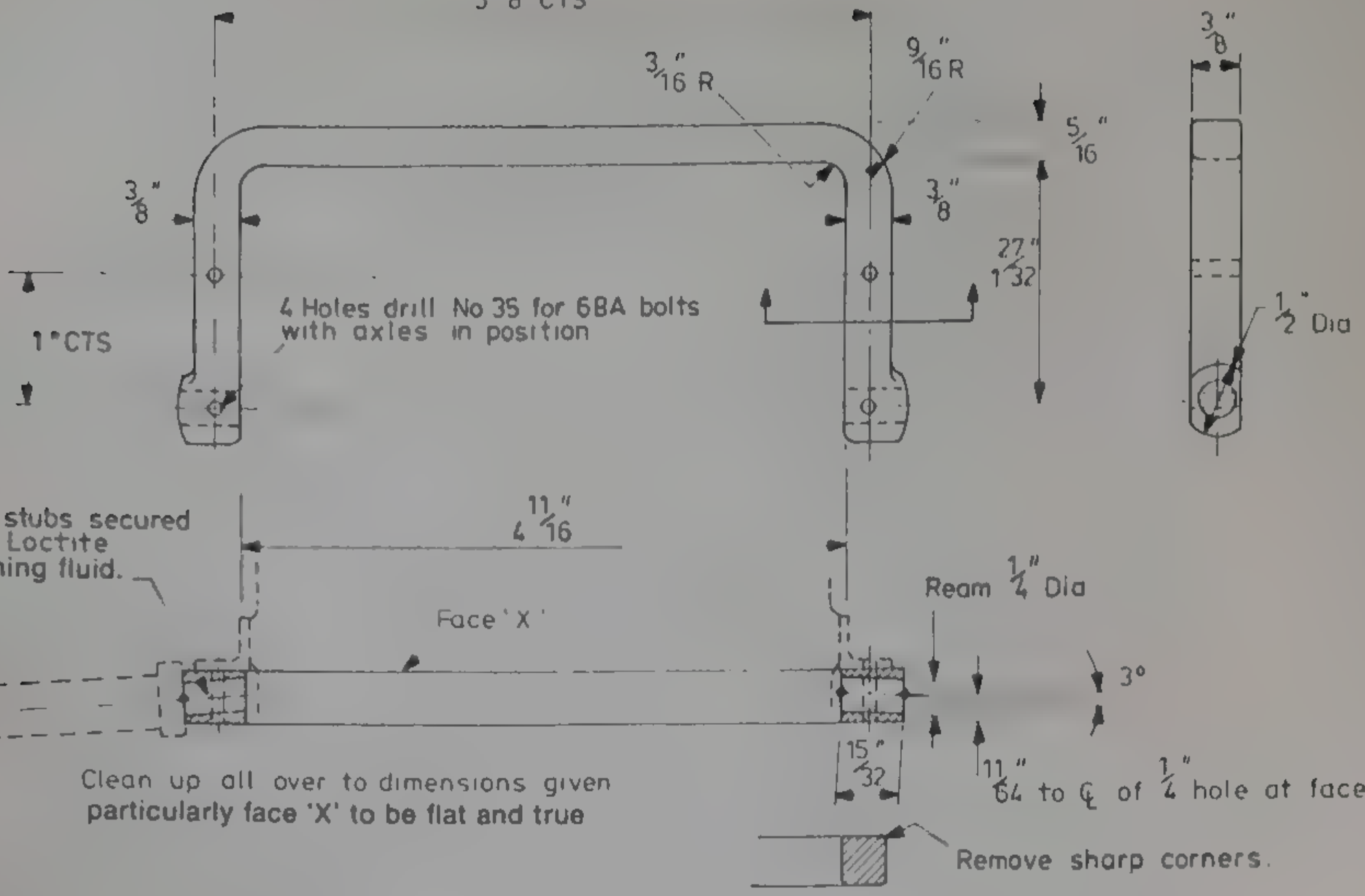
The 3/32 in. dia. holes at the rear ends of the angle plates are to take the anchor bolt or rivet for shackle links to be fitted, these links being, presumably, to facilitate towing the engine backwards. Don't be confused by the side elevation of the G.A. which shows the angle plate further forward than its proper position, the position of the hollow stays on the boiler detail is correct.

The G.A. also shows rivets for securing the angle plates to the boiler. I chose to use stainless steel bolts here, with bronze nuts in the inside of the firebox, mainly because it avoided the risk of damaging or distorting the boiler assembly when riveting.

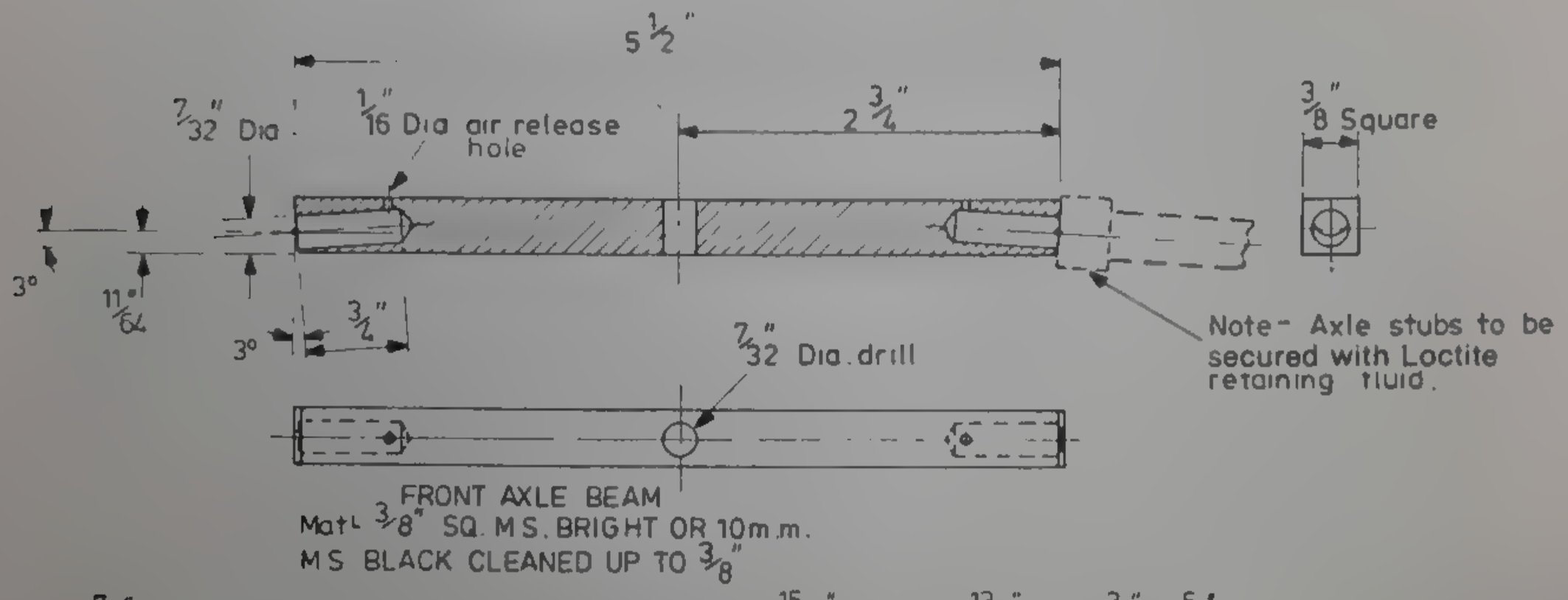
Turning now to the front axle and undergear — the design of the engine, as far as Bill took it, did not include any information on details of this part of the engine, and I have had to resort to some "free-lancing" here. However, I have a Marshall spare parts catalogue that Bill had by him, and the illustrations cover several models of Portables, giving a fair representation of various undergear castings.

The axle itself appears to have had a "banjo" formation in the centre of its length, presumably to add strength where the forecarriage bolt passes through, but with retaining plates holding the axle firmly in the slots in the undergear casting, the local weakening of the axle in the centre should not matter. The axle is, therefore, shown as a straight length of ⅜ in. square black bar. The ends are trued

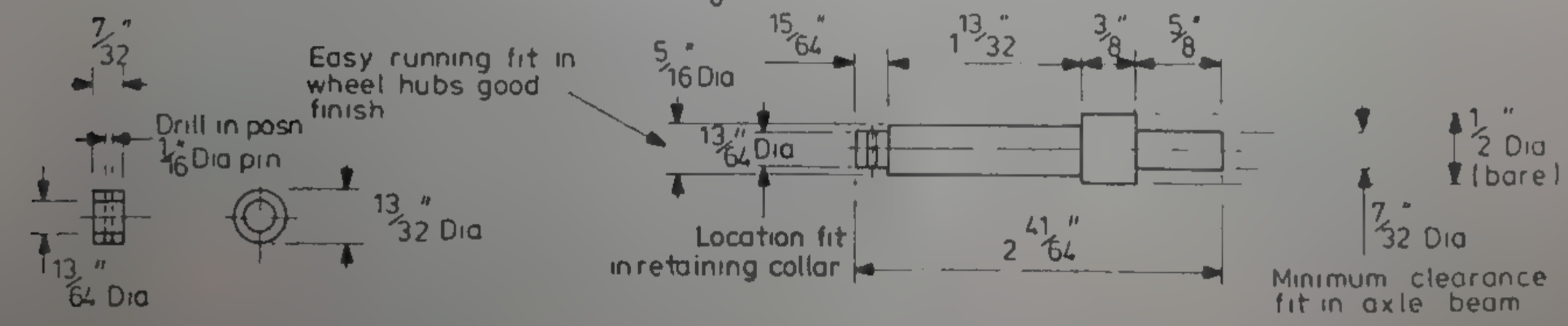




HIND AXLE 1off
Matl- CAST IRON



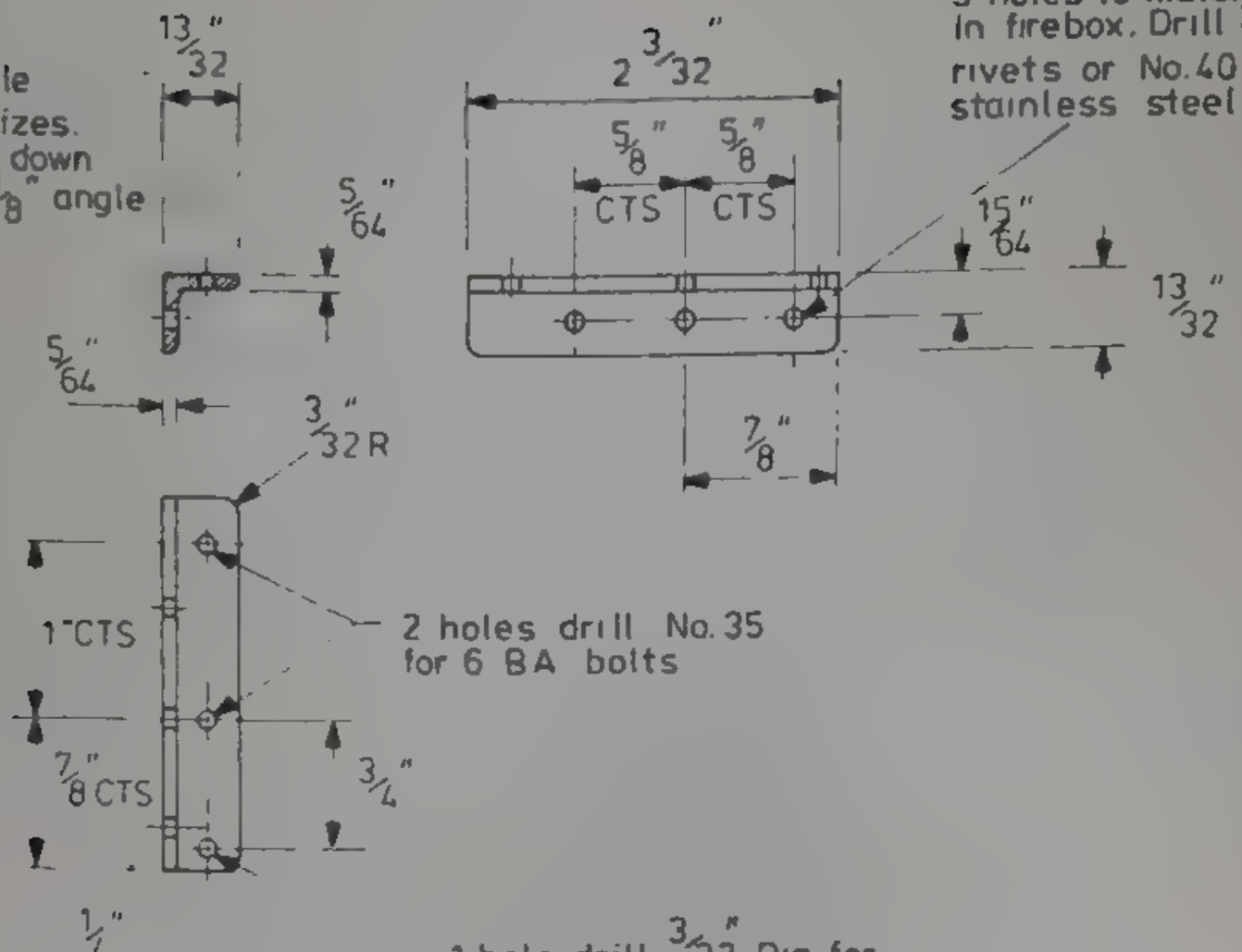
FRONT AXLE BEAM
Matl 3/8" SQ. M S. BRIGHT OR 10m.m.
M S BLACK CLEANED UP TO 3/8"



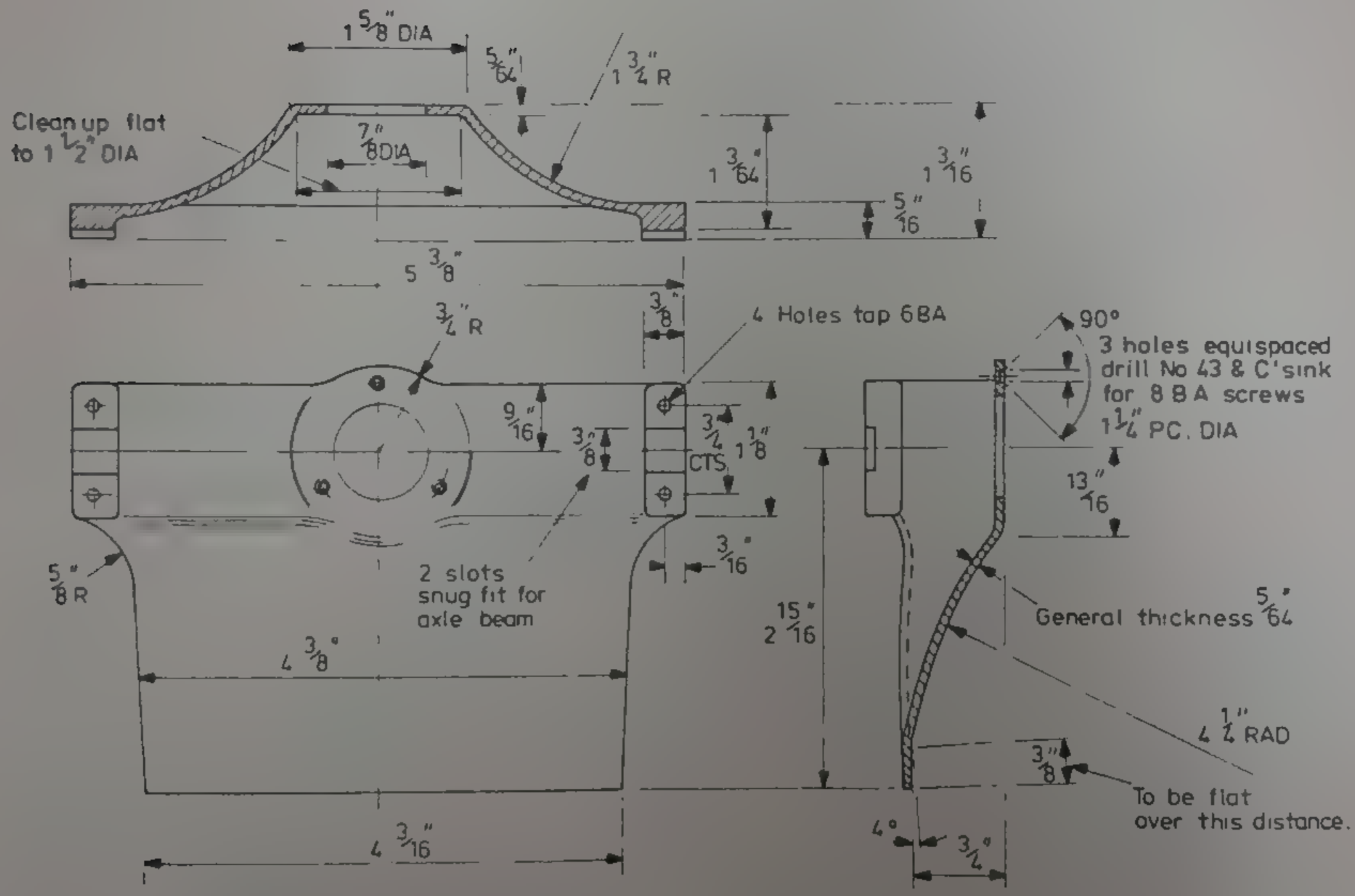
RETAINING COLLAR - 2 off
Matl M S OR STAINLESS STEEL

FRONT AXLE STUB - 2 off
Matl M S OR STAINLESS STEEL

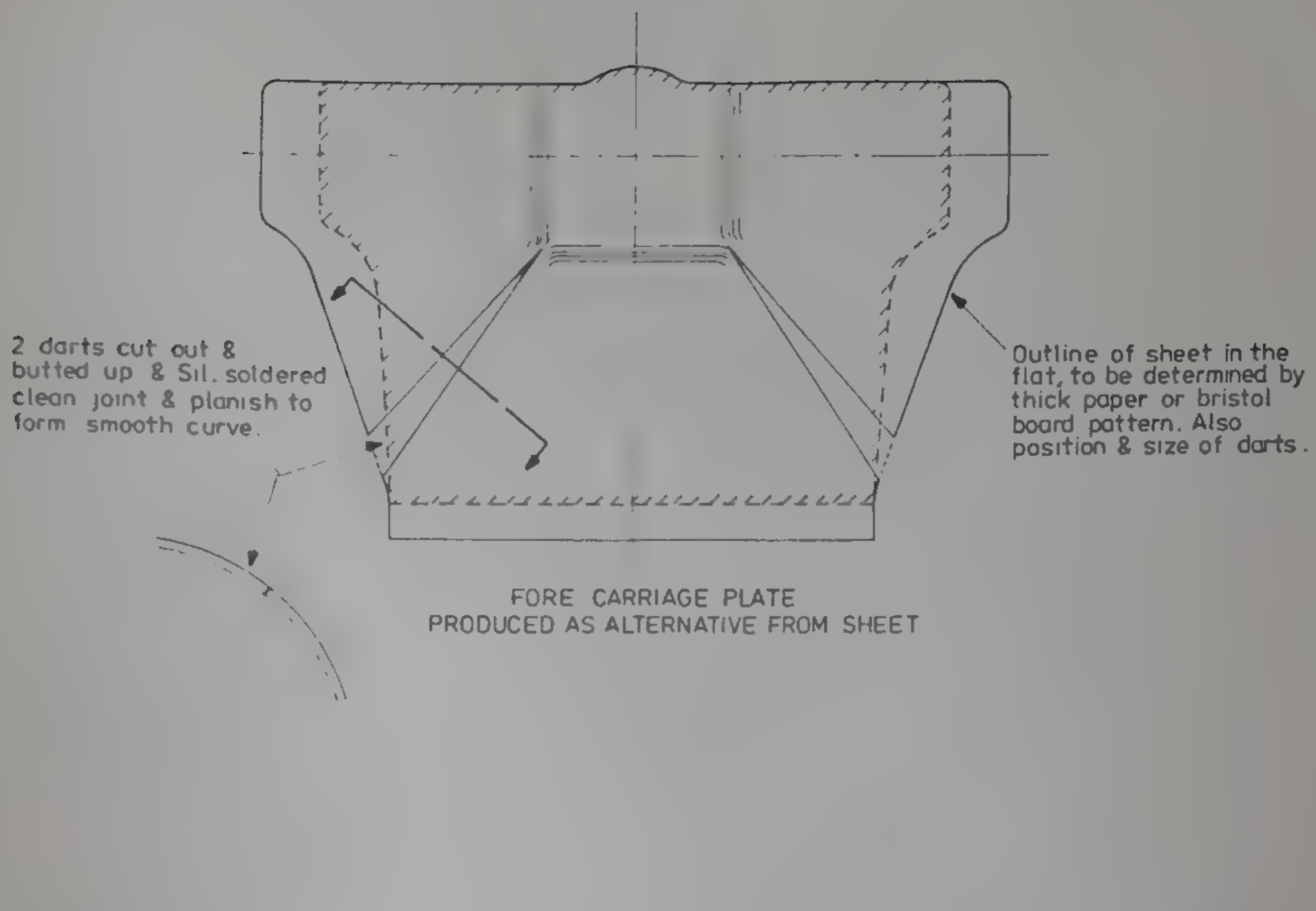
Note. No Commercial angle Available to these sizes. Produce by M/C'ing down square bar or ½" X ⅛" angle



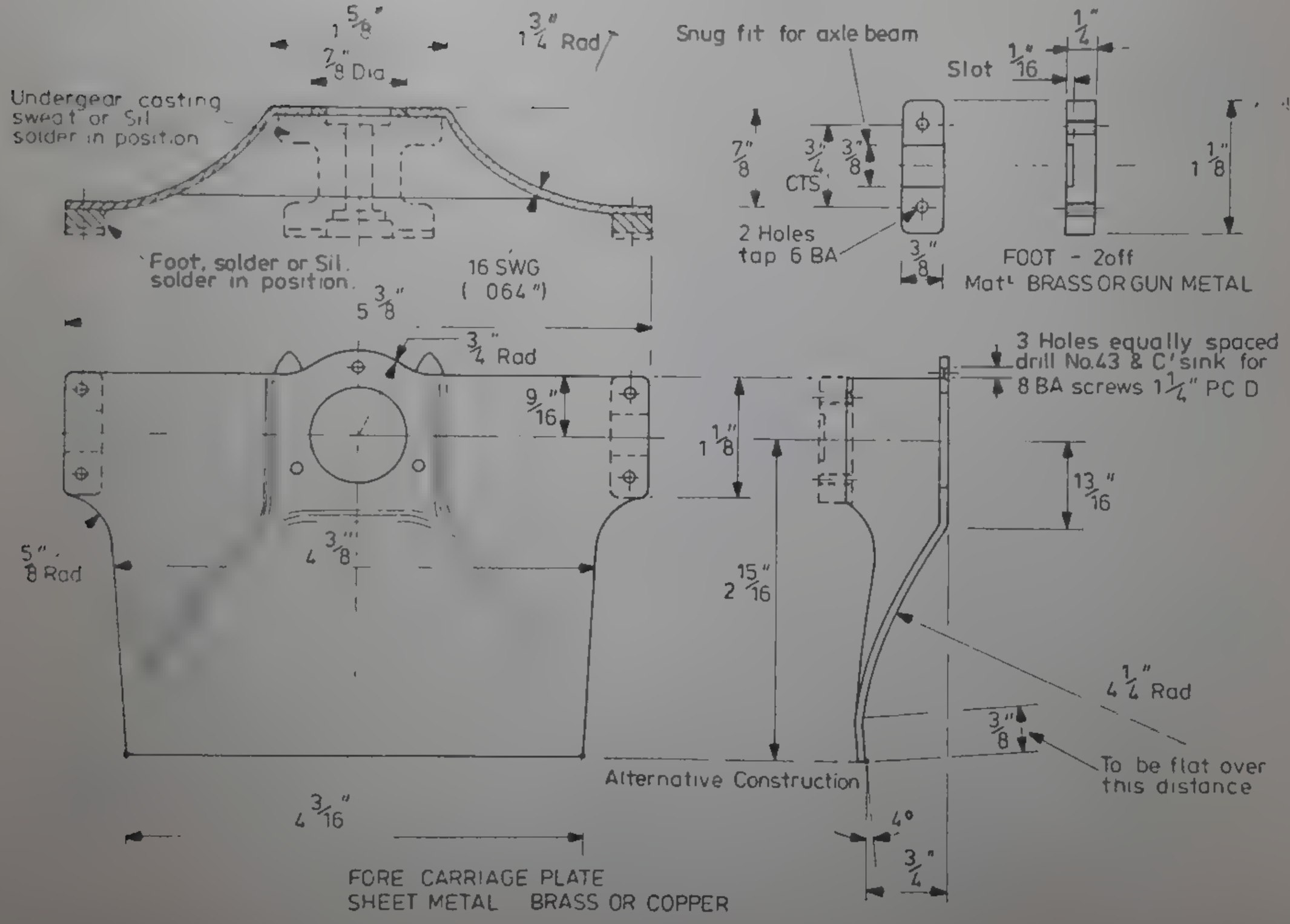
HIND AXLE BRACKET - 2 off (1 for Rt. Hd. as drawn)
Matl. MILD STEEL. (1 for opposite hand)



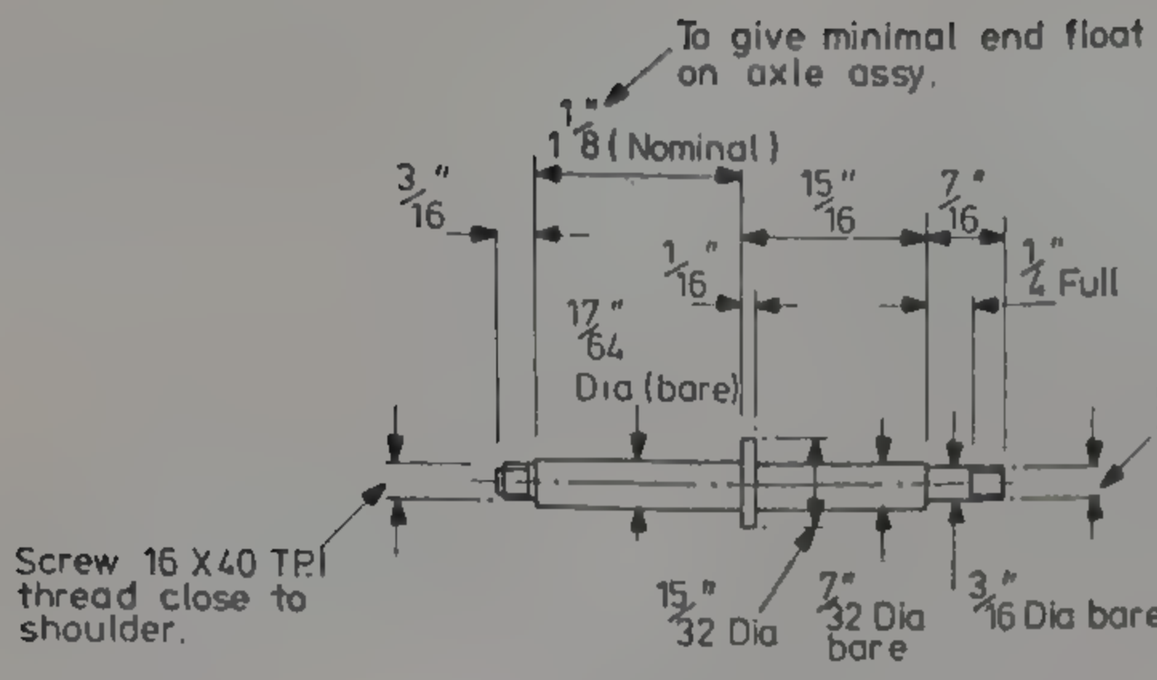
FORE CARRIAGE PLATE
GUN METAL CASTING



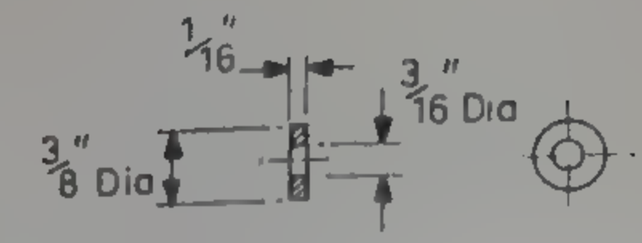
FORE CARRIAGE PLATE
PRODUCED AS ALTERNATIVE FROM SHEET



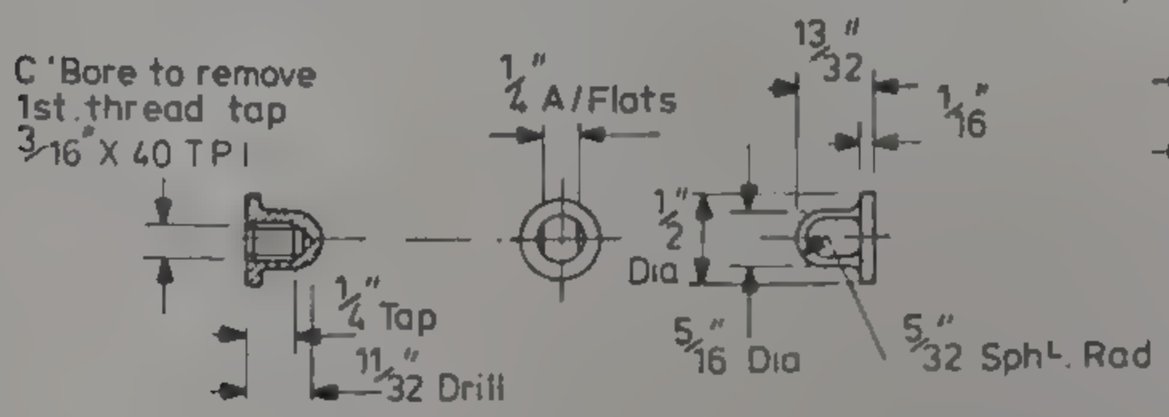
FORE CARRIAGE PLATE
SHEET METAL BRASS OR COPPER



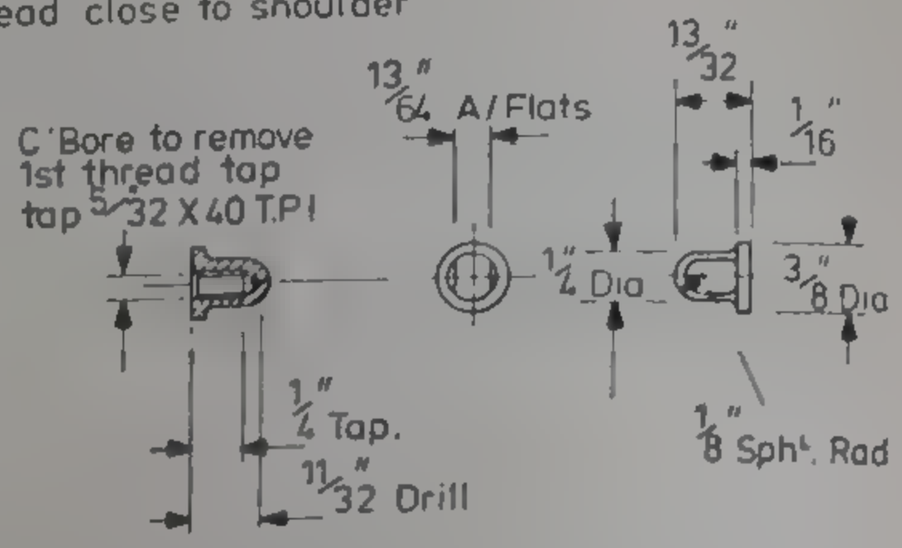
FORE-CARRIAGE BOLT 1off
Matl M.S. OR STAINLESS STEEL



SHOULDER WASHER - FOR CARRIAGE STAY NUT
1 off. Matl M.S. OR STAINLESS STEEL



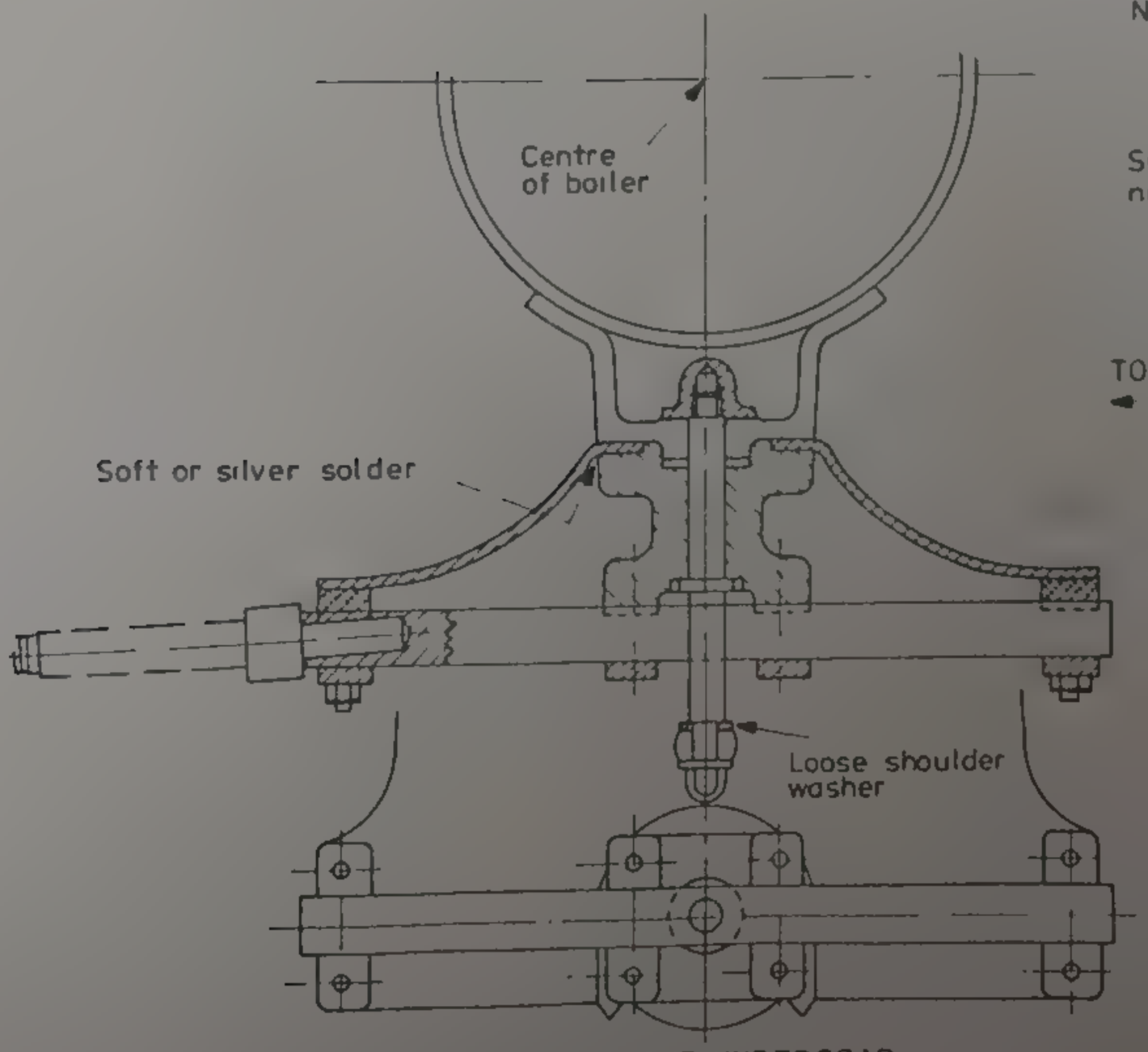
NUT - FORE CARRIAGE BOLT.
1off Matl. M.S. OR STAINLESS STEEL



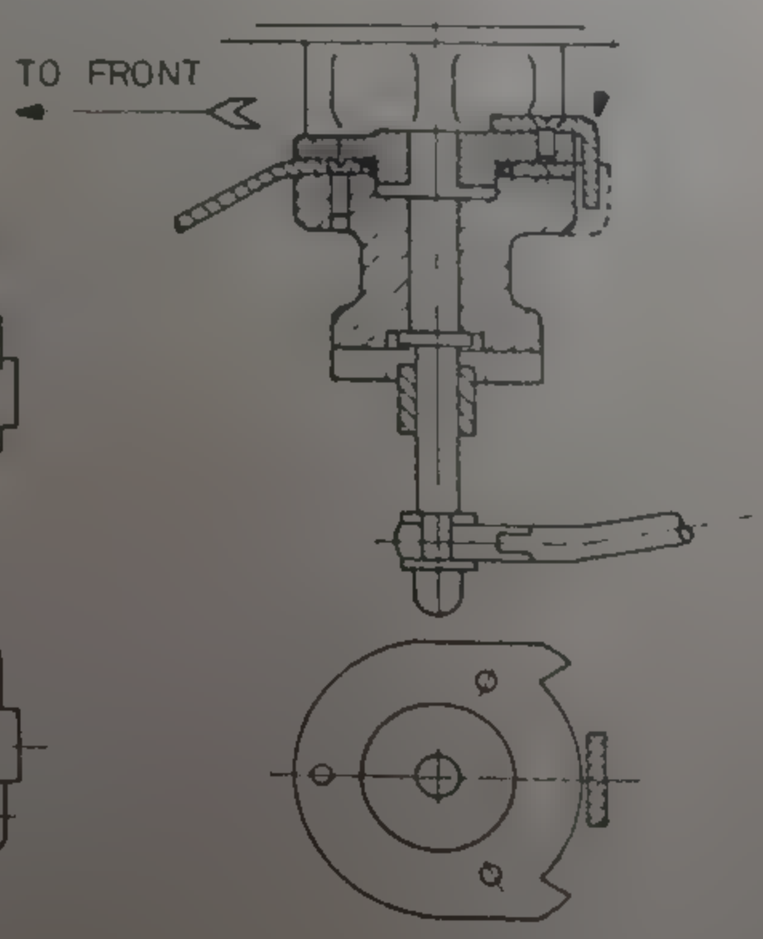
NUT - FORE CARRIAGE STAY ROD
1off Matl M.S. OR STAINLESS STEEL

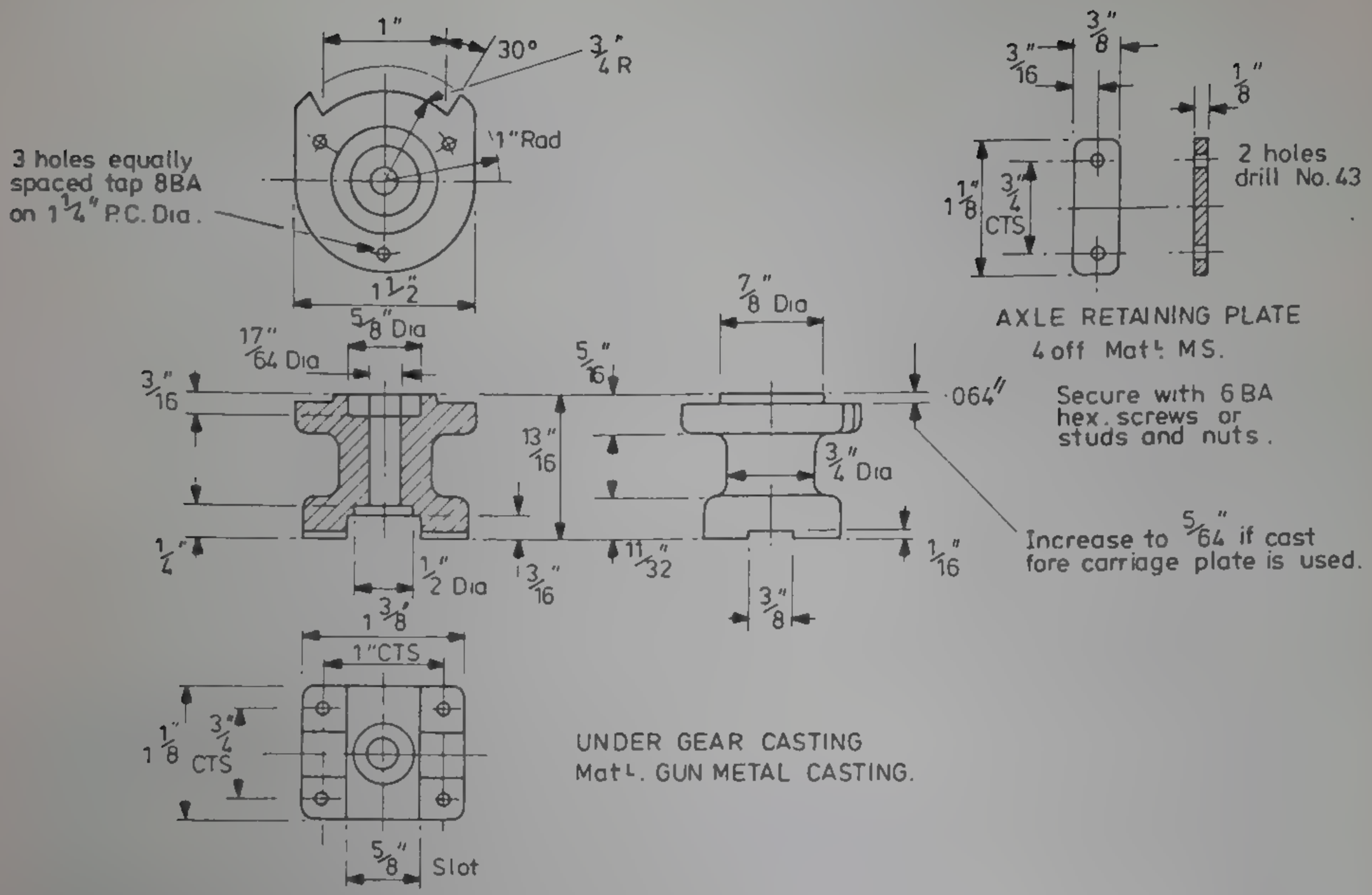
Note. Stop screwed & sil. soldered to perch bracket (HS 20 sht 2)

Suggest machine stop in phos. bronze not M.S. as quoted



ARRANGEMENT OF FRONT UNDERGEAR





off at 3° and square with the ends are drilled 7/32 in. dia. to take the axle stubs.

As with the rear axle, the stubs are called for to be Loctited in with retaining fluid, so a good fit is required — say, no more than .002 in. clearance on diameter. The two small air release holes ensure that the fluid is not forced out of the joint.

Considering next the forecarriage plate, I produced mine from 16 gauge annealed brass sheet, having first played about with several tries in Bristol board, followed by a final try out in thin tin plate. I am assured that Reeves will have castings in gunmetal available for the plate before this instalment appears and, no doubt, most builders will avail themselves of this. For those who wish to have a go from sheet, I am including a diagram.

The casting will, no doubt, require some "fettling" to produce a smooth finish, particularly on the upper surface, and a light facing operation on the surfaces that mate with the perch bracket and undergear casting. The slots to take the axle beam will need milling or careful filing, and also the forward edge on to which the tow bar is riveted. Reeves tell me that, although the general thickness of the casting may be a little greater than specified, the edge thickness will be held down closely.

Turning back to the sheet version, reference to the diagram will, I think, be self-explanatory. I found that, after determining the size of the "dart" to be cut away to get rid of surplus metal, and after neatly butt silver soldering after closing the dart, I was able to planish a smooth radius across this joint and to subsequently file it until no witness of the silver soldering was visible on the upper surface.

The machining of the undergear casting is quite straightforward and does not require comment, likewise the forecarriage bolt which extends beyond the casting to provide an anchorage point for the steady rod from the boiler throat plate. The detail of the steady rod will be given later.

In the next instalment, details of the wheels and axles will be given. The wheel rims with the inner angle for locating the spokes made integral should now be available as light alloy castings. As well as simplifying the design, the integral angle will add some rigidity to the casting when chucking for machining the rims. I know that this was how Bill intended to work.

Here again, in the absence of castings, I made my wheel rims by wrapping ¼ in. x 1 in. black strip round suitable formers and butt brazing with C.4 to make ring blanks. The subsequent machining in the 6 in. 4-jaw was, to say the least, a very "delicate" operation, since anything but the lightest of grips from the jaws produced unacceptable distortion. What was called for was the sharpest of tools, a depth of cut of only 2 or 3 thous at a time, and limitless patience. Anyway, my Marshall is there to prove that this method of construction is possible, and if I get any call to cover the steel construction as an alternative, I will follow up with the necessary information.

To be continued

A Light Compound Steam Tractor
at 2 in. Scale

Part XII

From page 500

John Haining concludes the series by discussing final details and painting

THE BLAST PIPE joins the exhaust branch flange at the chimney (front) end of the cylinder casting, running in plan view on the boiler centreline straight into the lower end of the chimney. The aperture to accommodate the pipe, where it passes through both the chimney itself and its flanged, lower ring should be elongated just enough to allow the pipe to be inserted, any clearance space between chimney and pipe being filled with fire cement once the exhaust pipe is fitted in position.

Owing to the "one-piece" construction of the chimney it is obviously difficult to use an adjustable blast nozzle of the type used on the Aveling roller and other engines which have a separate cast chimney base and easily detachable chimney. The small bore copper blower pipe, not shown on my drawing, should be inserted through the chimney on the nearside, the pipe turning upwards and finishing alongside and level with the tip of the blast nozzle. I have left the end of the blower pipe slightly flattened but without a nozzle.

The blast nozzle dia. externally should not exceed the blast pipe O.D. if the aperture through the chimney is to be kept as small as possible.

Drain Cocks

These on the full size Ransomes tractor are coupled together with a short spindle, the cocks on both HP and LP cylinders lying with their plugs on the horizontal centreline as shown on my drawing with the back (crankshaft end) plug being extended to carry on its squared end a short lever arm connecting by flat bar linkage with the lever arm on the forward end of the longitudinal operating spindle.

This spindle runs along the outside of the boiler and is supported at the cylinder end by a small steel bracket off one of the cylinder holding down studs, and at the tender end by the transverse plate between hornplates. The layout of drain cocks and operating gear on the 2 in. scale engine follows the same arrangement, for which Loco Parts have arranged to supply the drain cock bodies, screwed 3/16 in. x 40.

It will be necessary to make the taper drilled plugs one single and one double ended for each cylinder together with the operating linkage, spindle and handle; I have deliberately omitted the cross linkage length from the drawing as this will have to suit the actual drain cock centre distance across the boiler top.

The connecting spindle between the cocks should not be larger in diameter than 3/32 in. and all pins should be 20 s.w.g. steel wire as on the long operating spindle.

The Ransomes arrangement shows the drain pipes leading straight down from the cocks to beneath the boiler barrel and not bent to run together equidistant between the two cocks as on a lot of engines. These drain pipes, in 2 in. scale, should be 3/32 in. dia. copper if they are not to appear slightly out of scale.

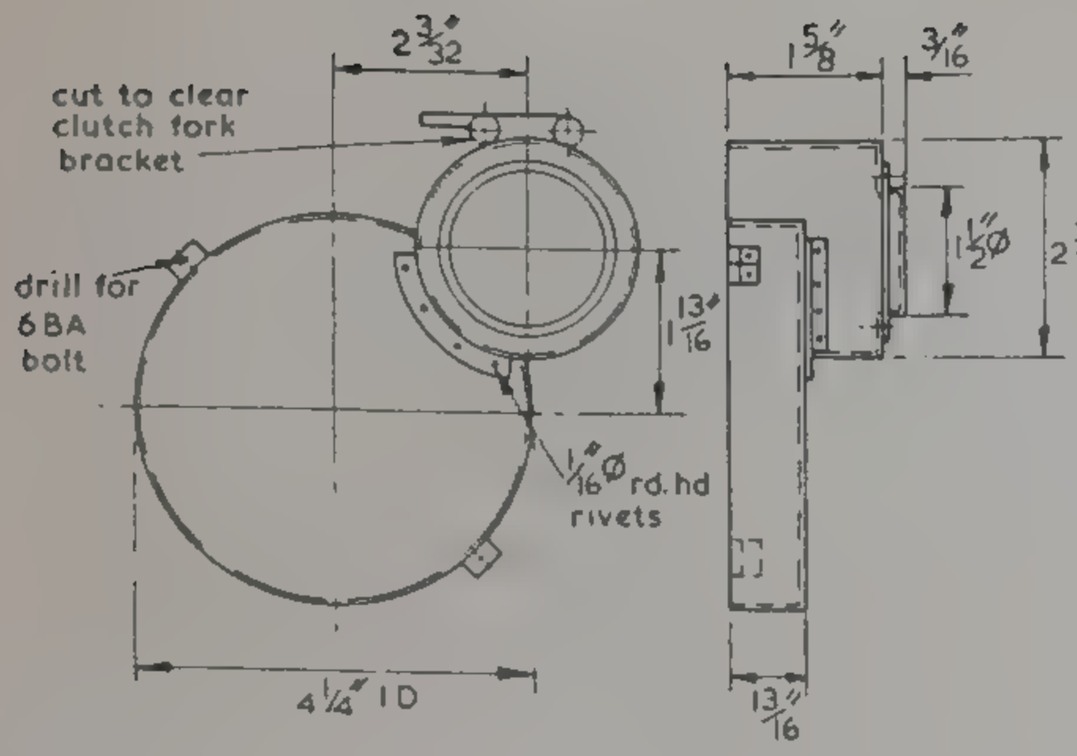
If no drain cocks are fitted, condensate water will pass through from cylinder and steam chests via the exhaust pipe into the bottom of the smoke box and if there is too large a quantity of water, back through the lower tubes into the firebox. My old 2 in. scale Fowler single cylinder engine was not fitted with cylinder drains, and to avoid this flooding of the smokebox, she was fitted with a water collector pan or tray mounted on a transverse bracket in the smokebox, well below the chimney aperture. This was sufficient to catch most of the water emitted on starting and the heat passing through the tubes and up the chimney soon evaporated the collected water. This is an easily put together alternative to fitting cocks should anyone wish to avoid the small fitting work necessary.

Brakes

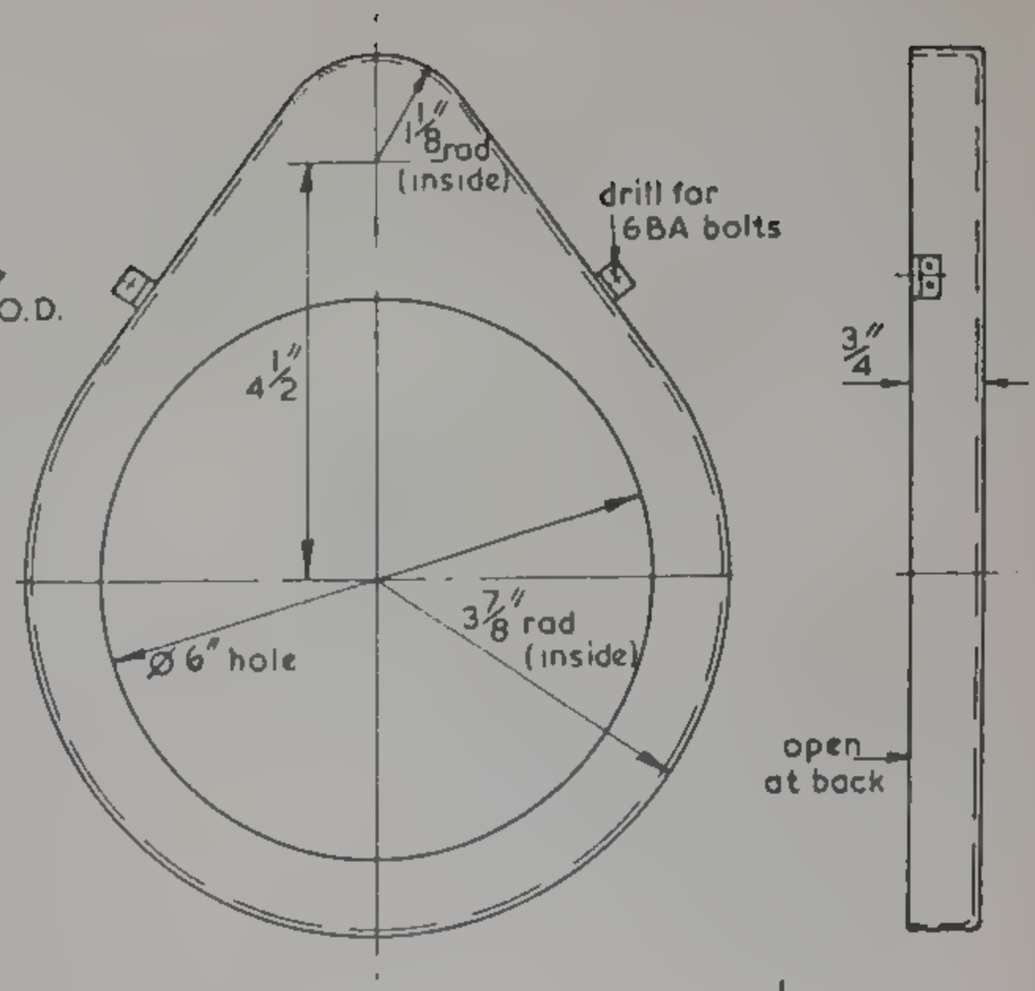
The brake shoes consisted of shaped hardwood blocks (ash was frequently used) set in flat carrier plates, the turned inward edges of which secured the block in position and took the sheering load off the screws holding the brake block into the back plate, when brakes were applied.

The linkage was simple enough, the transverse brake shaft running through the tender encased in a steel tube, and actuated by arm connected to the vertical screwed brake spindle topped by a plain handle. On a squared length at each extreme end of the cross shaft were fitted the two arms connected to the brake shoes.

The vertical brake spindle ran through a small cast bracket bolted to the inside of the offside tender sideplate, and to allow for the slight angularity imposed on the spindle when it turned to move the brake arm through an arc, the hole through the bracket was slightly elongated to give fore and aft clearance for the spindle. The actual amount of



COMBINED GEAR GUARDS (offside)



ROAD GEAR GUARD: (near side) ½ F S.

"tilt" was very little as the shoes in the "brakes off" position only just cleared the inside of the wheel rim and the brake could be applied with a few turns of the handle. The arms holding the shoes in plan were offset so that the cross shaft did not extend each side beyond the edge of the wheels.

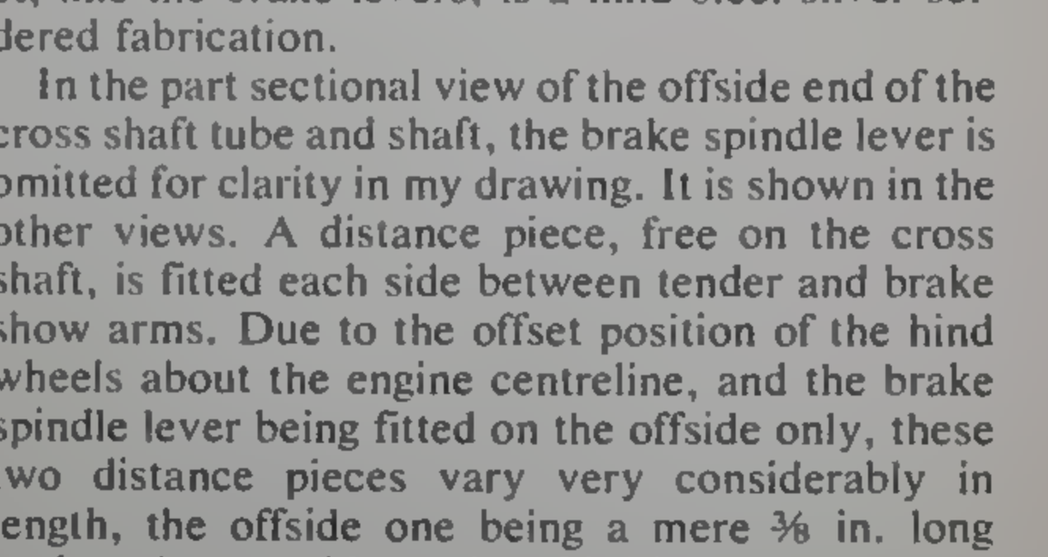
In order that the brake blocks would operate on a smooth and uniform surface a flat ring was secured inside the inner vee ring extending from the wheel edge almost up to the vee itself. If this is not fitted, care must be taken to ensure that the inner ring of rivets securing strakes to the vee rings are countersunk inside the wheel and not standing proud. On my drawing of the brake gear, I have omitted giving a radius on the brake block face as this will have to match the inside of the wheel vee ring, and is best marked off on assembly.

The two lugs on the back face of the brake block plate should be silver soldered in position, this operation made easier if a small spacer is bolted between the lugs to keep them the right distance apart and square. The wooden blocks are retained inside the back plates by small woodscrews. The ½ in. bore cross shaft tube is fitted with a brass or gunmetal bush each end, which should be press fits inside the tube, alternatively leave these .003 to .004 in. clearance and use Loctite to position them. Whichever method you use, it is wise to run a reamer through before fitting the cross shaft, to ensure that the bushes have not closed in or misaligned. Referring again to the vertical brake operating spindle I have used No. 2 BA thread although it was usual to make the threaded lengths of these spindles square or even knuckle threaded.

A small collar is pinned to the bottom end of the screwed spindle, the dia. being turned down to the thread bottom to accommodate this. Where the spindle screws into the threaded yoke pin, the holes in the yoke boss (on the end of the lever arm) must be elongated to allow for the radial arm movement when the brake is applied and the spindle tilts slightly. The yoke pin with 2 BA hole through must be an easy fit in the yoke boss. Likewise the brake spindle bracket bolted to the inside of the offside tender soleplate, must be sufficiently elongated in the bore to allow for tilt of the spindle. This bracket, like the brake levers, is a mild steel silver soldered fabrication.

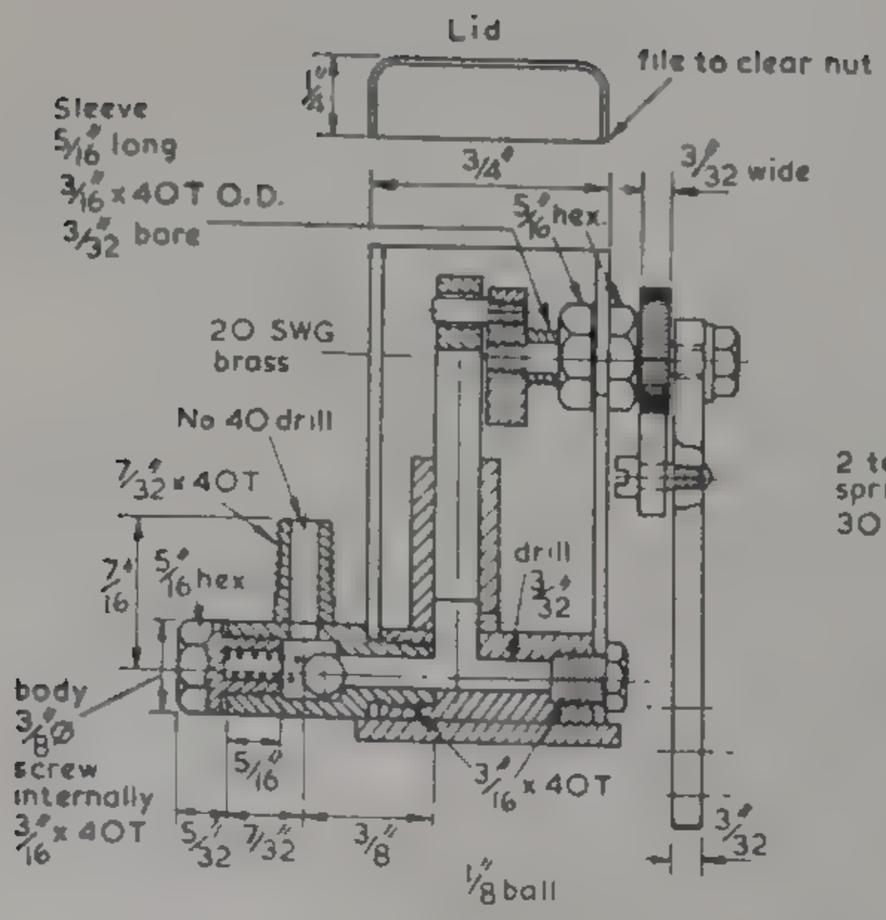
In the part sectional view of the offside end of the cross shaft tube and shaft, the brake spindle lever is omitted for clarity in my drawing. It is shown in the other views. A distance piece, free on the cross shaft, is fitted each side between tender and brake show arms. Due to the offset position of the hind wheels about the engine centreline, and the brake spindle lever being fitted on the offside only, these two distance pieces vary very considerably in length, the offside one being a mere ⅜ in. long against the nearside one's 1 7/16 in. long.

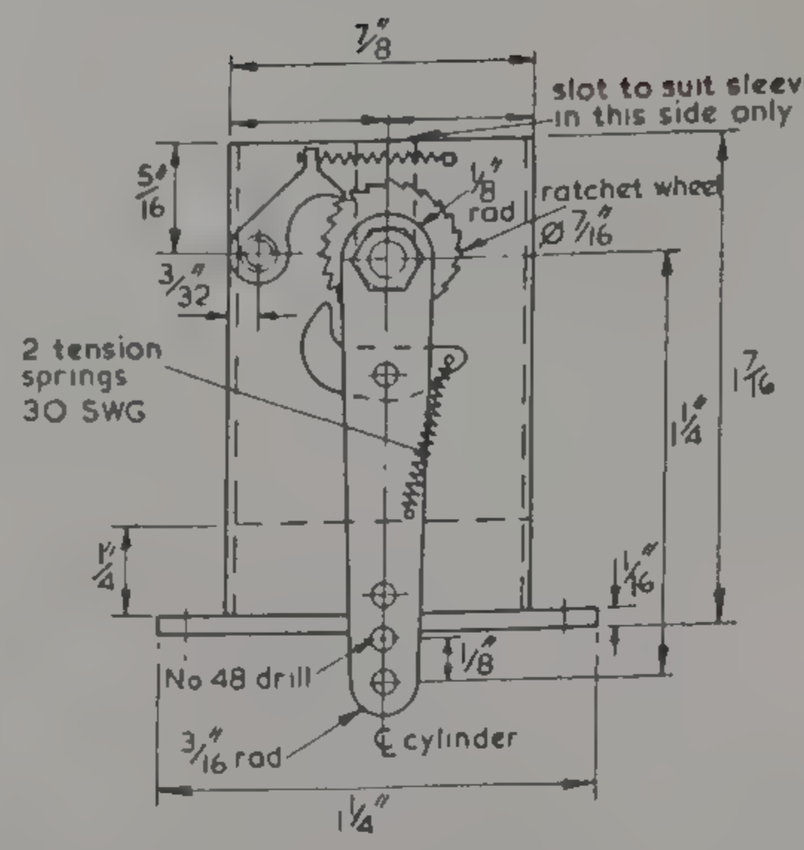
Both brake shoe lever arms fit on ¼ in. square

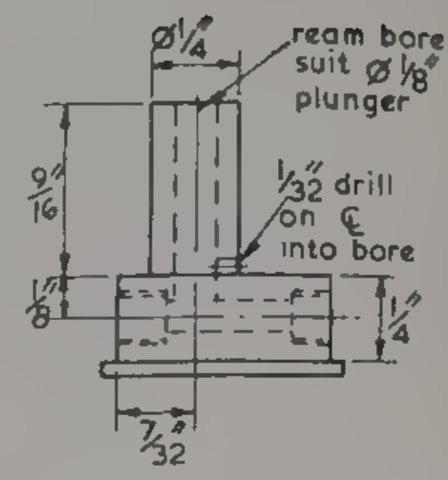


Detail of lining each side of brass boiler bands.

POSITION OF BOILER BANDING (not to scale)

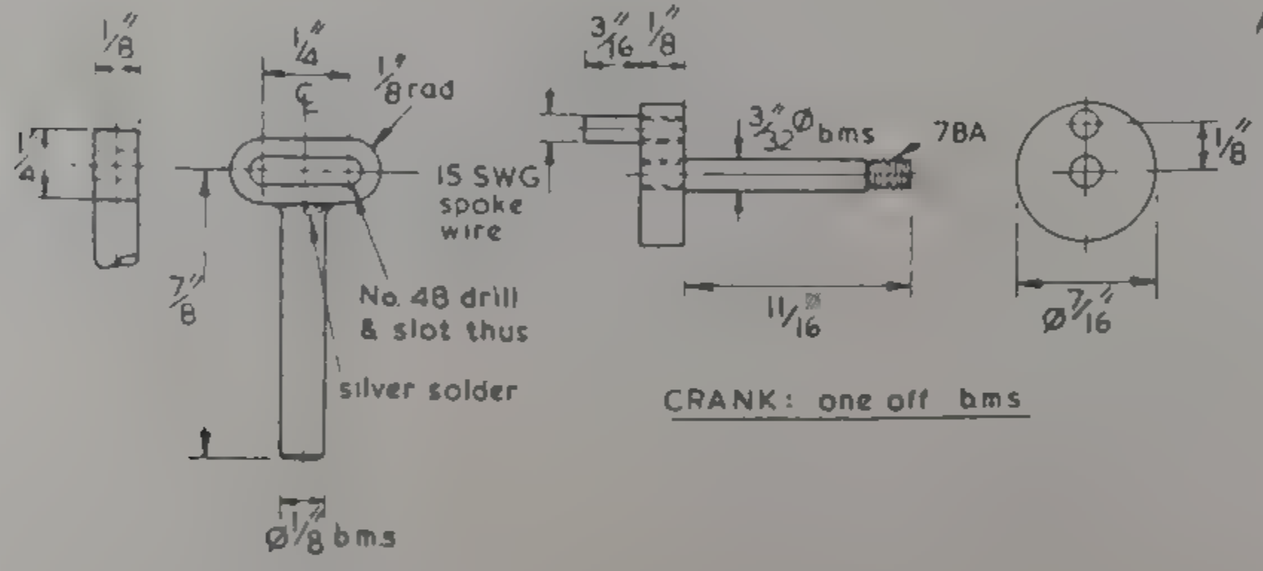






CYLINDER BODY & VALVE BLOCK:
one off: brass

All joints silver soldered



CRANK: one off bms

Ø1/8 bms

PLUNGER: one off
Head. brass
Body bms

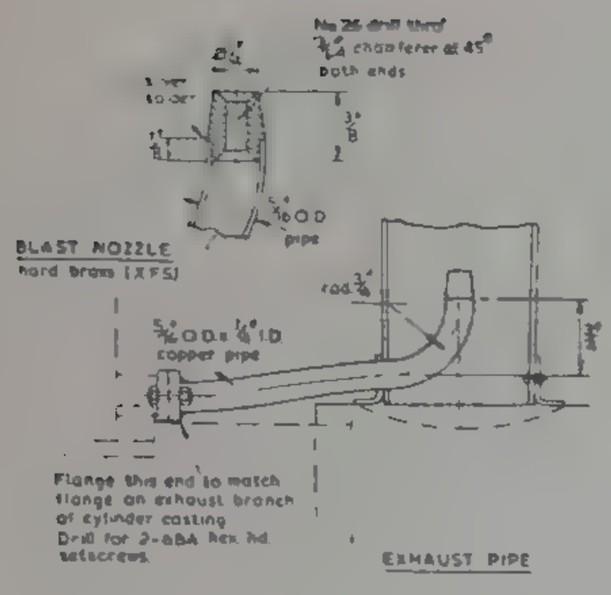
lengths at each end of the cross shaft secured in position by 1/16 in. steel pins through boss and shaft. I have left the brake spindle lever loose on the cross shaft until the wheels are in position and the brakes adjusted for movement when this lever can be finally positioned and pinned through the shaft.

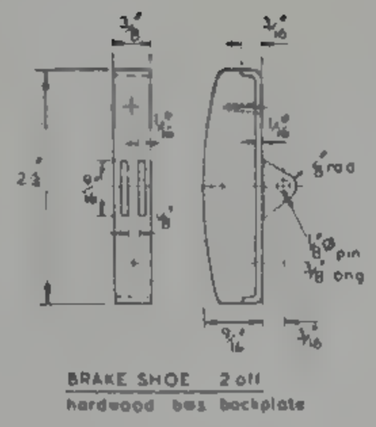
Painting and Livery

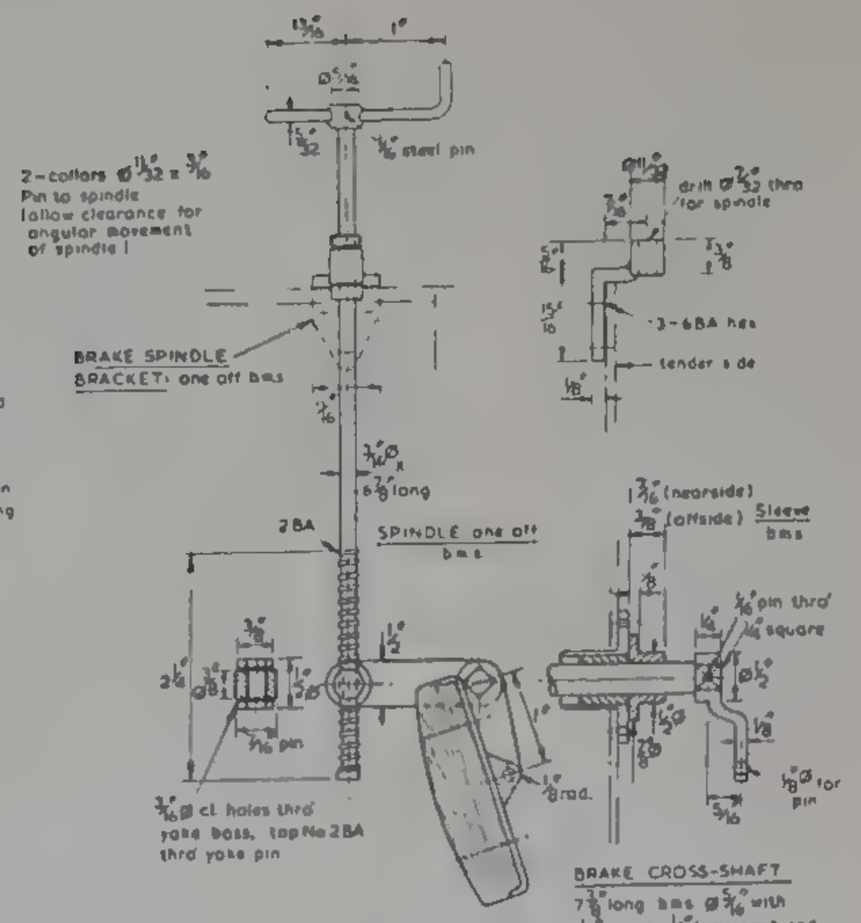
No definite specification covering the painting and lining out of these engines appears to have survived but the official works photograph gives a reasonably clear picture of which areas were lined out and a colour photograph of Mr. Limbs has helped considerably by giving the principal colour areas. Smokebox, chimney and perchbracket are black (the matt finish heatproof smokebox paint is recommended for these). The circular Ransomes, Sims and Jefferies nameplate on the smokebox door is polished brass with bright red background. Boiler, belly tank, tender and side and end boards of the awning are all dark green. The top of the awning is black, the inside dull white. Wheel, vee rings, spokes and hubs should be a not too bright red, the inside of flywheel black, and the outside green, and I am finishing the inside of hornplates in bright red.

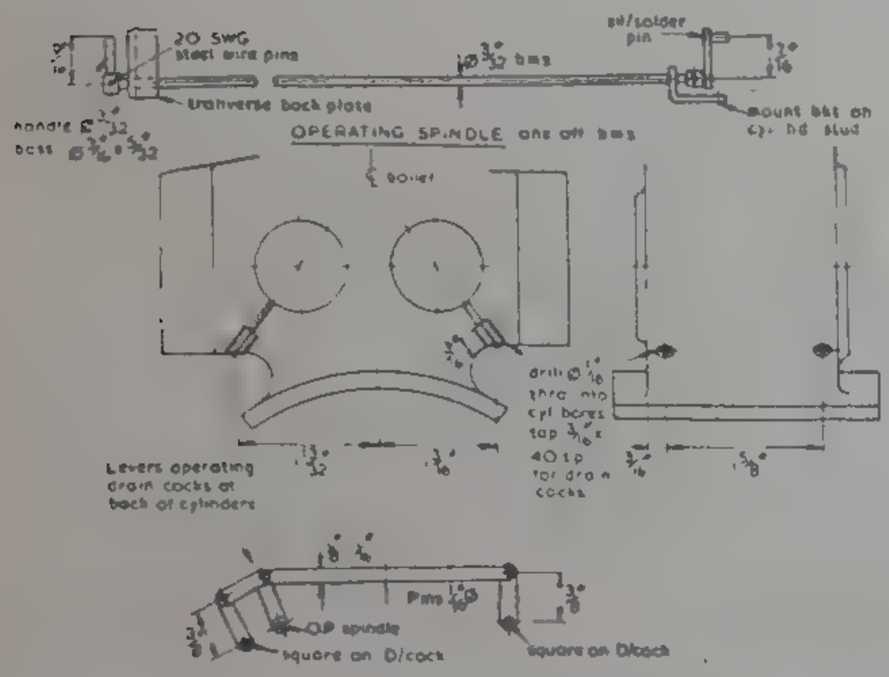
The outside edge or face of the flywheel should be left a bright finish and the outside surface of the front and hind wheels left unpainted if steel shod; if rubber shod the outside of the wheel should be dull black where not covered by the tyre width. Boiler lagging may be narrow wood strips as in full size practice, or one of the strip lagging materials now available. Whichever of these materials is used it should be secured in place with thin copper wire before fitting the thin, sheet metal, cladding; wooden strips should not be wider than ¼ in. otherwise the cladding will not fit neatly over it, in true circular form.

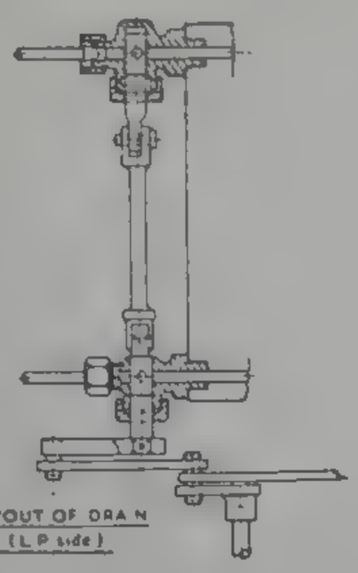
Boiler bands are ¼ in. wide, preferably about 1/32 in. thick, one at the smokebox end, one about

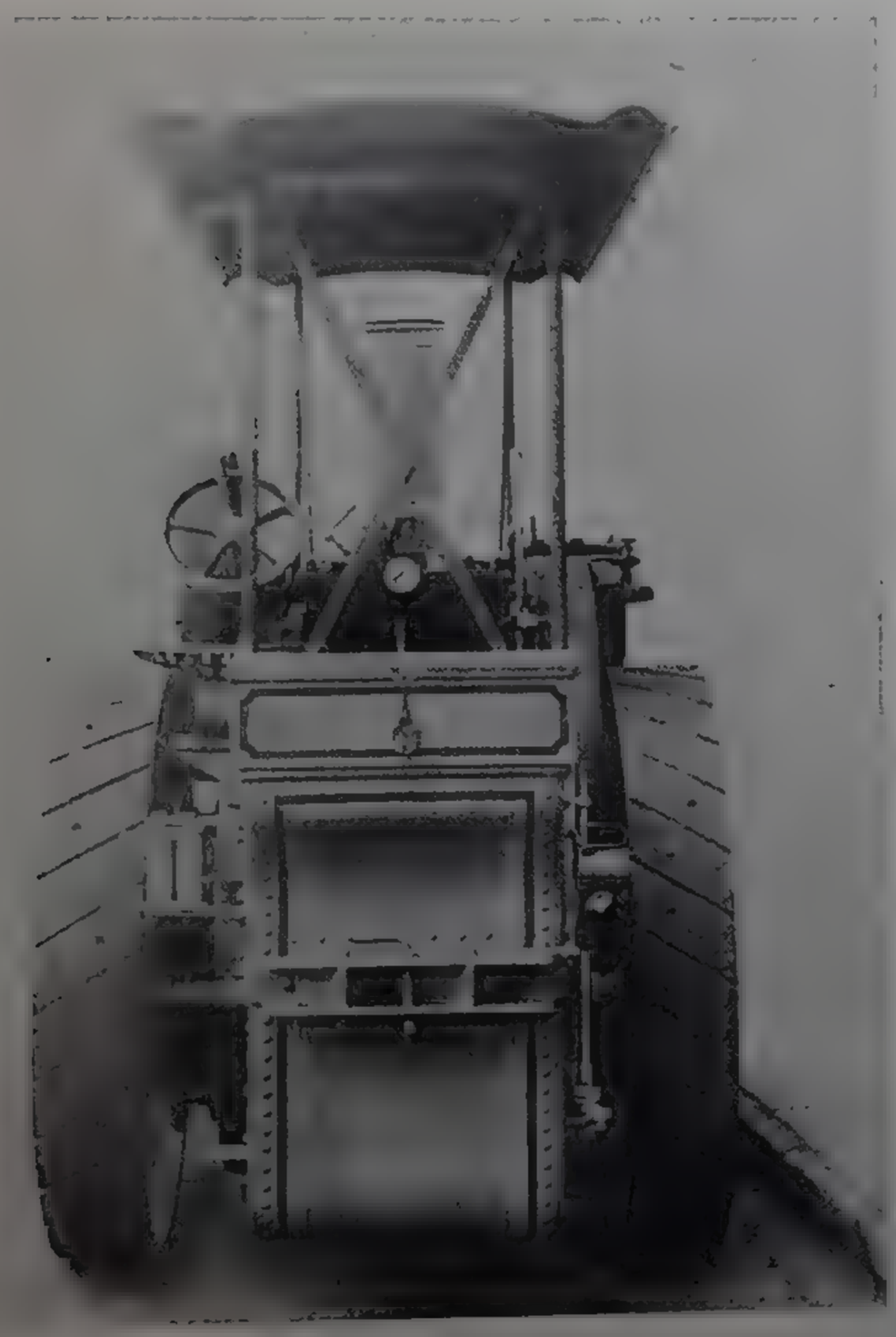












Rear view

level with the back of the belly tank and one about half way along and below the cylinder bottom flange. This latter is an awkward one as on the 2 in. scale tractor this is a steam joint, whereas in full size it isn't (see the article dealing with the construction of the cylinders), so in order to keep the band in its correct position relative to the other two it is turned over and "hooked" over the edge of the cladding each side to appear as if it fits below the flange of the casting. The smokebox stands out from the boiler dia. slightly to allow for lagging thickness and when fitted in place the cladding must lie flush with the smokebox outside diameter.

I don't rely on boiler bands alone to keep cladding sheets in place, preferring to make the sheets in two halves which are then temporarily kept tightly in place with a couple of bands of wire while I join the two halves together with a couple of dabs of soft solder before painting and fitting the brass bands — and of course removing the wire. Don't forget to give the inside of cladding sheets a coat of red oxide or similar anti rust paint before assembling on the boiler.

The three boiler bands are each flanked by a 3/32 in. wide black band contained by outer red bands of the same width each side. Personally I stick to the same brand of heatproof, steamproof paint, "Humbrol", mixing several individual colours to obtain the shades I require, and the small tins of smokebox paint supplied by Loco Parts.

Needless to say I have no interest or connection

with the paint manufacturers other than having used the product for a long time, very satisfactorily. Now one or two points regarding the awning or canopy. The vertical columns supporting the awning are formed into flat palms at top and bottom and these support the transverse frame members being bolted to the *front* face of the wood members.

The cross stays at the back end bolt to the *back* of the wood member but those on the columns mounted on the hornplates bolt to the *front* side of the wood cross member, while the two stays bolt to the back edge of this member.

The two back colums are joined by a flat bar silver soldered to a short collar or ring on each column to which the back cross stays are also bolted. The transverse tool box is bolted to this flat bar with two 6 BA bolts. The short front cross stays have a thicker section silver soldered at the bottom so that they can be bolted to the extended lower palm of the vertical columns.

On the short awning there is an end board each end, and three frame cross members. The long awning (shown in chain dot) has an end board each end, and four frame cross members, the front one having only one column on the centre line.

The side facia boards are radiused at each end and surrounded by half round beading, the felt covering tucking under the top run of beading. As I remarked earlier, the full size roof was merely felt over wood rafters and runners.

In 2 in. scale I think it will be easier to use a thin sheet metal roof, with material cemented to the outside to simulate felt — it is almost impossible to obtain a sharp bend without cracking the felt, if anything but the thinnest and cheapest variety is used and this is liable to sag and stretch anyway.

Now one or two engine notes: a displacement lubricator may be fitted over each steam chest if desired, but the better method of lubrication will be by using the oil pump illustrated with this article and which I have standardised for 2 in. scale engines. It is slightly over size in appearance but not I hope, too intrusive when mounted above the trunk guides and worked off the inside of either crosshead by a short arm. The water lifter fitting on top of the offside of the belly tank should be screwed to suit the end hose connection — mine is ¼ BSP fractionally over scale but easier to use with this standard thread. Filling plugs on the boiler are two in full size, one back below the crankshaft and one above the steam inlet elbow at the back of the cylinder casting. I am using the back one only utilizing the internally screwed bush for a short plug.

Official works photo showing long awning, steel wheels, and lining out.

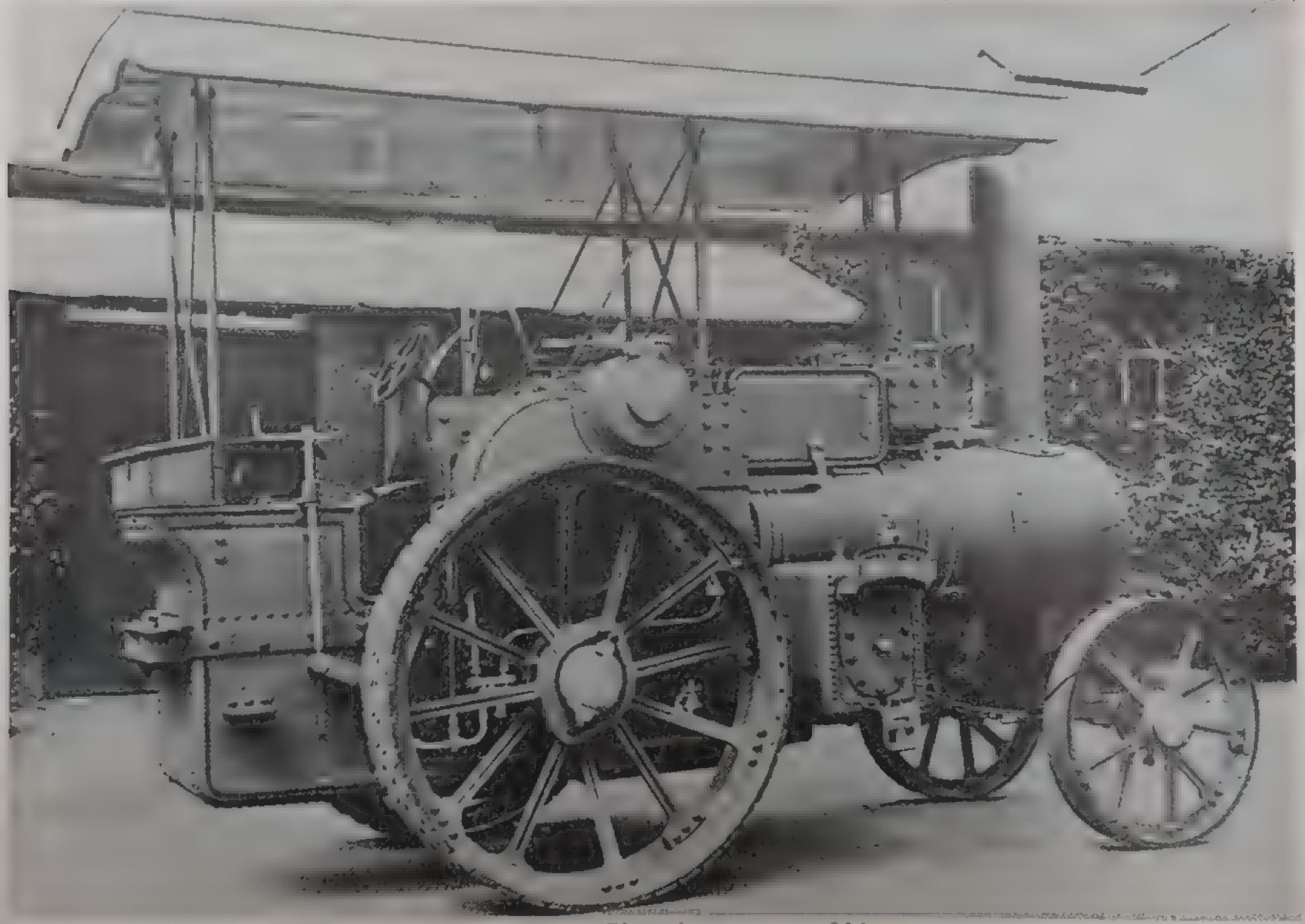


Photo by courtesy of Museum of English Rural Life, Reading.

THE PISTON DROP VALVE ENGINE

Part II

by A. Haworth

From page 516

WITH REGARD to the valve liners, much work is saved if a short piece of stainless steel tubing can be obtained. If the bore and O.D. are very close to that required, other dimensions may be modified accordingly. The actual valve is simply a block with two piston rings, and since it is very small, there is little to be gained in removing more metal. If obtainable, the rings are best purchased as finished articles from model engineers' suppliers.

The dashpot spring is best chosen by trial and error. The tension may be varied by the adjusting screw in the top cover. The full maximum travel of the valve spindle is ⅜ in. but in the model, provided the governor linkage is correctly adjusted, cut-off will occur almost immediately after admission, since the load on the engine is practically non-existent. The valve operating sleeve on the spindle is integral with it, therefore assembly must be made each side of it. Ensure that the openings in the bonnet are well clear of the valve lever when operating. The valve lever is made from oil hardening steel, therefore it is necessary to ensure that this component is suitable in every way before hardening. One end fits the collar on the spindle whilst the other end forms the valve tripping edge, the lever is bushed after hardening. The valve spindle labyrinth portion must be machined with perfect precision relative to its bush and care spent here will be amply rewarded.

Having chosen a correct dashpot spring, the spring cap plate may be machined. The spigot fits the inside diameter of the spring and the top is dimpled to take the end of the tension adjusting screw. The top half bonnet is a gunmetal casting and carries the bracket in which the valve lever pivots. The bracket extends to form a guide for the end of the valve rod. At the end of this bracket should be soldered a light leaf spring, which ensures that the tripping edges are always ready to engage at the commencement of the stroke. The pressure exerted by this spring need only be slight. Always remember that all forces exerted at this point have to be overcome by the governor linkage and a centrifugal governor by itself is not capable of large forces. Any such forces will upset the stability of the governor and cause "hunting".

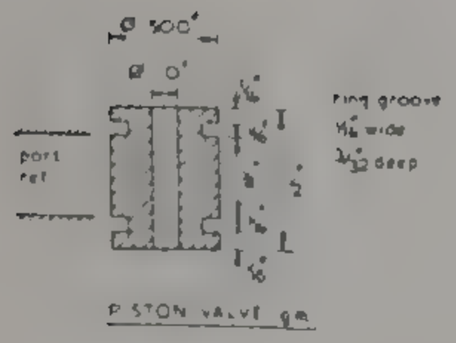
On assembly, do not expect the trip gear, etc. to perform perfectly. Few components assemble exactly as per drawing, otherwise many fitters would be out of jobs. Many adjustments will be necessary before that nicety of balance is achieved. Caution is the watchword. It is not easy to remove metal from hardened surfaces but it is even more difficult to put it back!

The exhaust bonnet is made in two parts, the body, which contains the spindle gland, and the end which forms the bearing. The two parts are screwed together by a thread of the modeller's choice. It should be a reasonably fine thread, say, not less than 30 t.p.i. Once assembled the bonnet need never be dismantled.

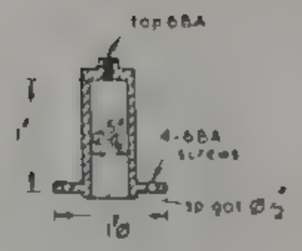
Never machine components *blindly* from a drawing. Study it. Is it to fit anything? Is anything to fit it? Once removed from the chuck etc. it is difficult to rechuck with perfect truth. A drawing leaves as much unsaid as what it says. Remember that a half inch shaft will *not* fit a half inch hole, except by force. I would not care to pedal a "bike" with such bearings.

The exhaust valve covers form the outer bearings for the valve spindles. The valve levers which drive the spindles may be attached with a BA nut since the force required to move the valve is or should be small. The LP cylinder covers are both fitted with glands, the front cover for the piston rod, and the rear cover for the airpump tail rod. The HP cylinder has only its front cover fitted with a gland, these are shown on the drawing as screwed type glands but if preferred the oval gland with studs may be used. With reference to the neck bush, that is the bush at the bottom of the stuffing box, there are conflicting opinions about these. Some argue that they are unnecessary and that the hole for the rod need only be slightly larger at this point; some argue that they are required and that they form another bearing for the rod. Others say that only a neck ring is needed i.e. a disc. This is neither one thing nor t'other, obviously. Since it is the labour of the model engineer, it is his choice but the engine will run equally as well with or without and personally, I am in favour of it.

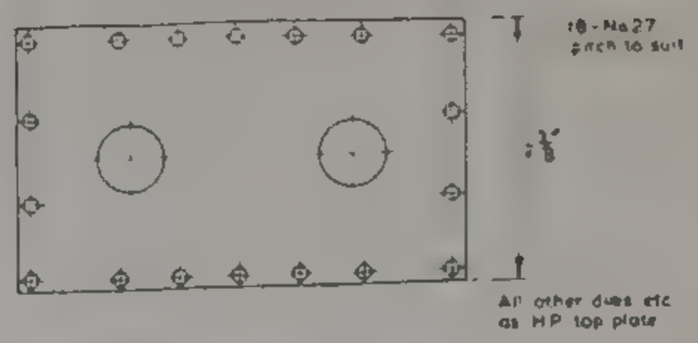
The LP cylinder is similar to the HP but of course larger. The drilling of the top plates is used as a template to locate the drilling of valve block and cylinder block. The bottom plate is utilised in a similar manner for the underside of the cylinder block. In all drilling and tapping operations, it is important that holes do not break through into



PISTON VALVE gm

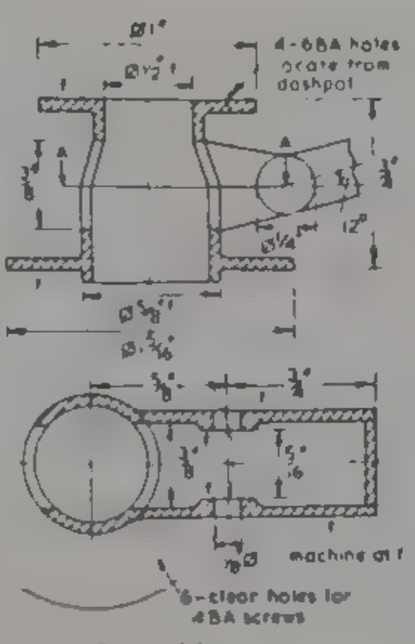


DASHPOT CYLINDER
brass



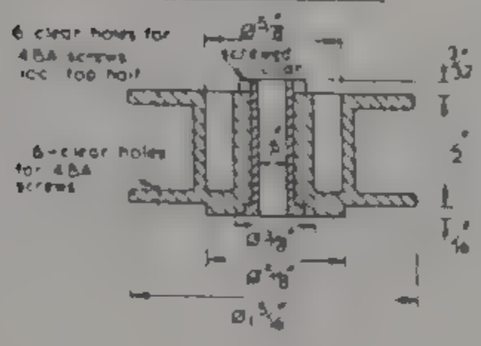
L P TOP PLATE

DASHPOT PISTON gm

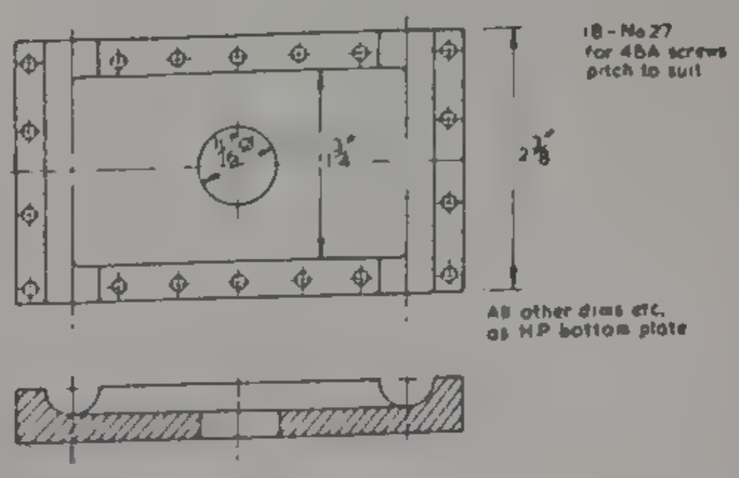


Sect on AA

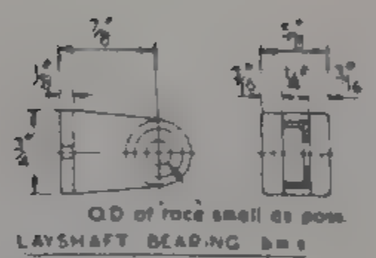
TOP HALF BONNET



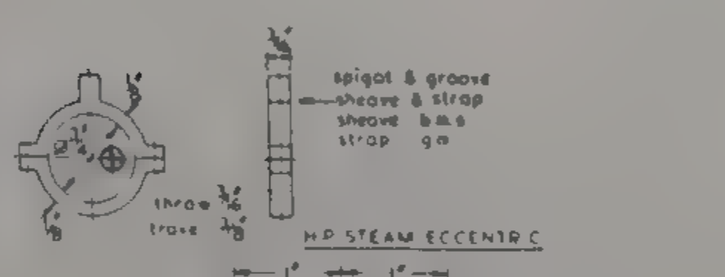
BOTTOM HALF BONNET bms
Fit with ph/bronze bush



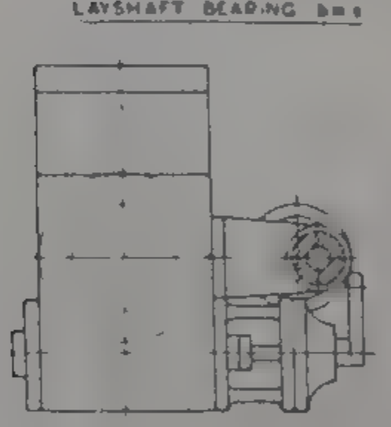
L P BOTTOM PLATE

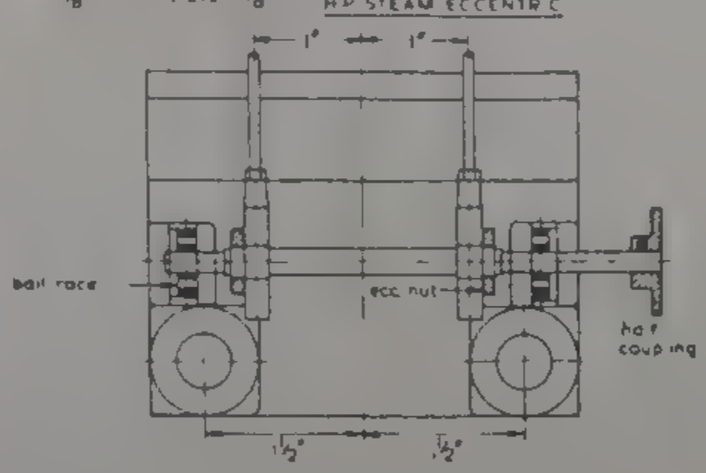


LAYSHAFT BEARING bms

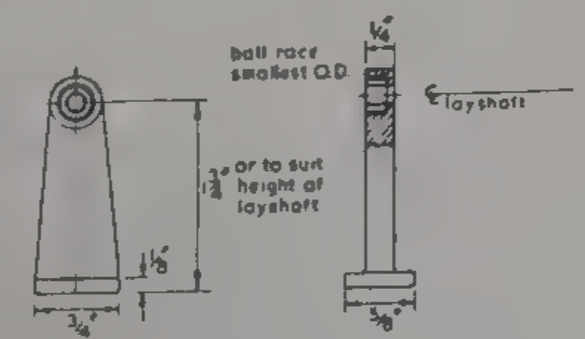


H.P STEAM ECCENTRIC

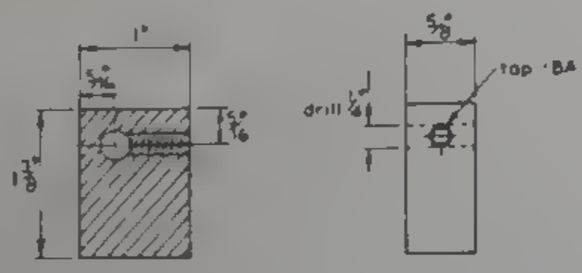




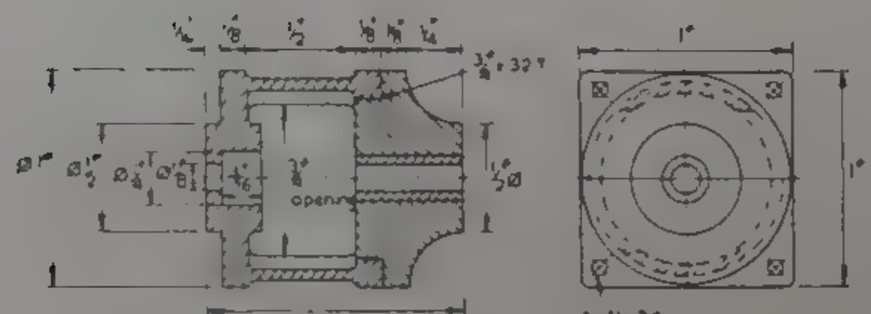
H.P LAYSHAFT & ECCENTRICS



LAYSHAFTS INTERMEDIATE BEARINGS bms



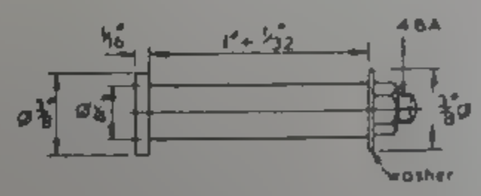
ENGINE CROSSHEAD BLOCK. bms



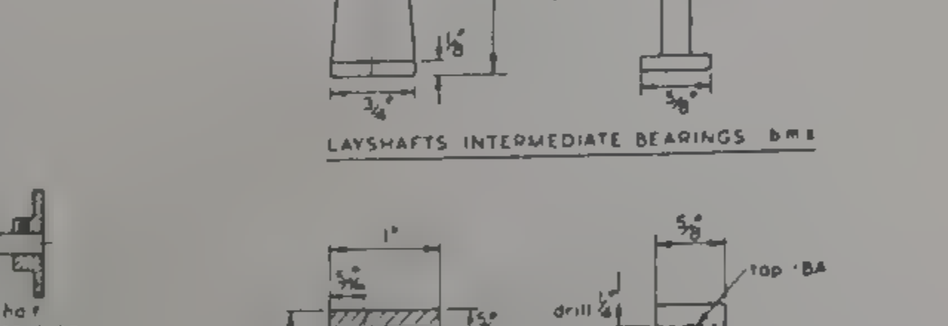
4-No 34

EXHAUST VALVE BONNET bms
Fit with ph/bronze bush

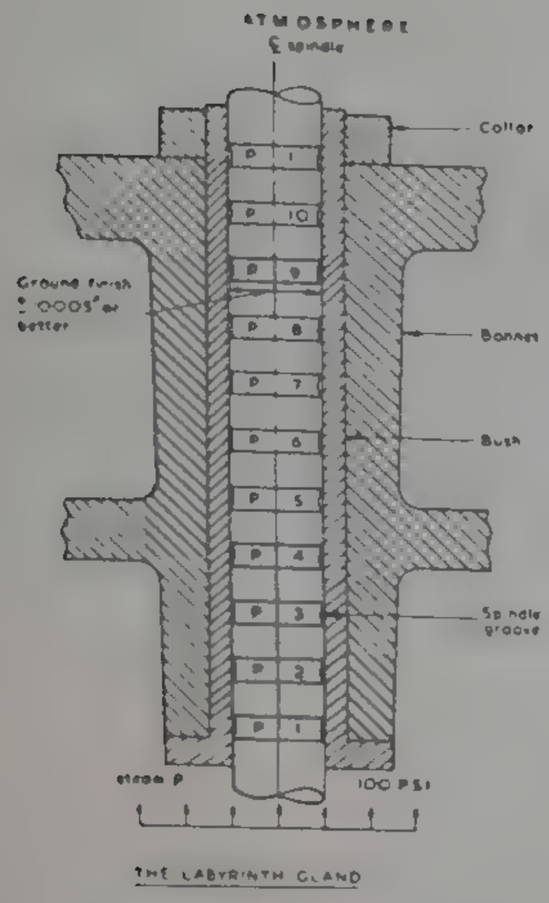
EXHAUST VALVE COVER bms
Fit with ph/bronze bush



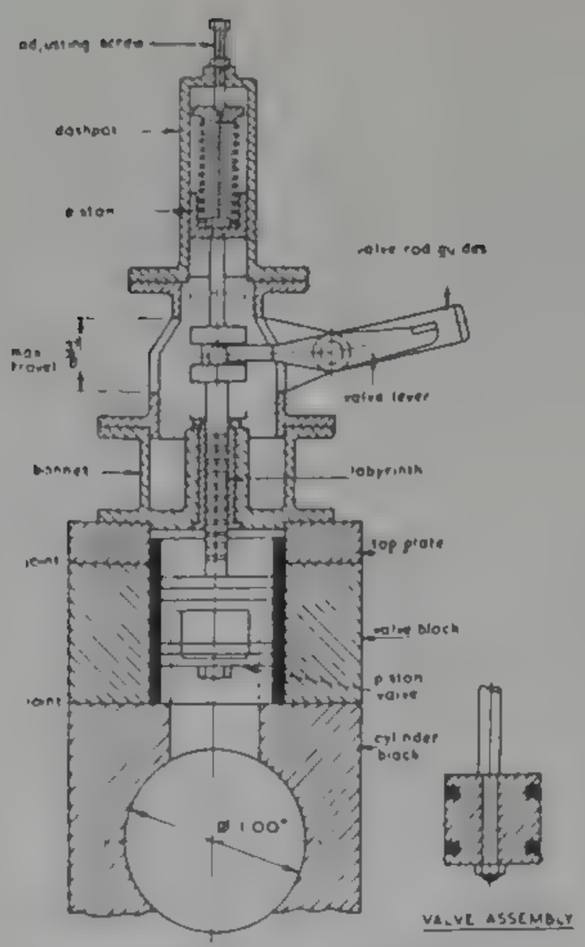
CROSSHEAD PIN silver steel



EXHAUST VALVE SPINDLE bms

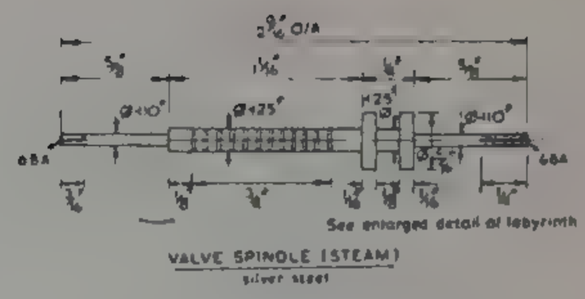


THE LABYRINTH GLAND

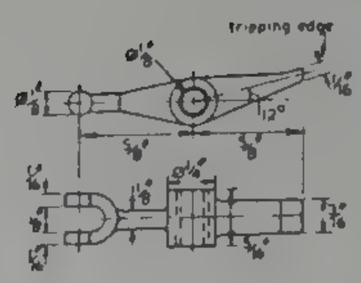


VALVE ASSEMBLY

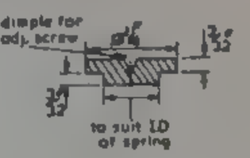
ASSEMBLY ARRANGEMENT OF STEAM VALVE HP CYLINDER



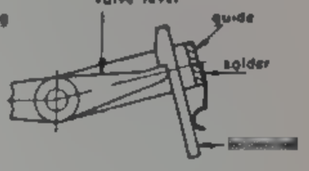
VALVE SPINDLE (STEAM)
silver steel



STEAM VALVE LEVER
Fit gh/bronze bush after hardening
oil hardening steel

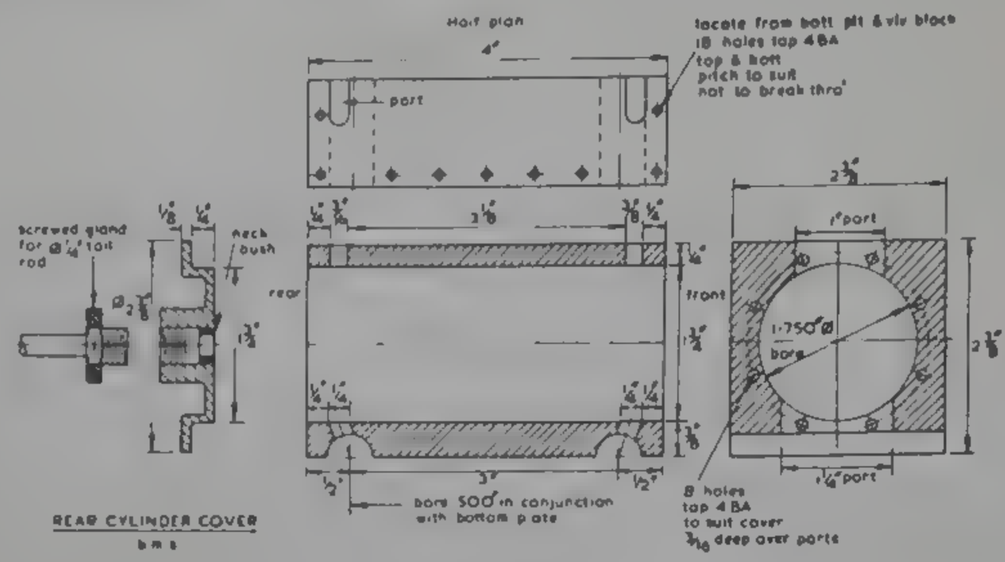


SPRING CAP PLATE: brs



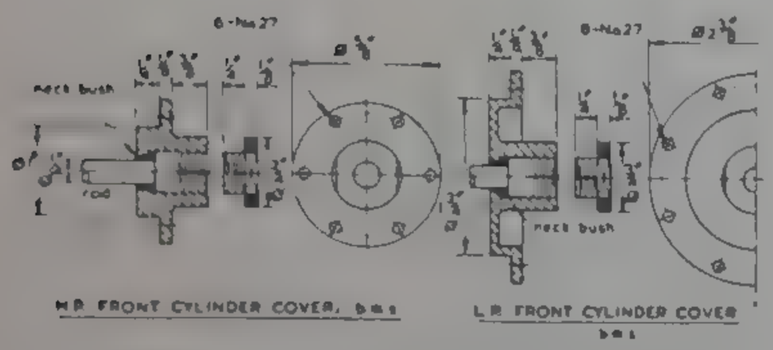
TRIP SPRING
silver steel

VALVE LEVER PIN brs



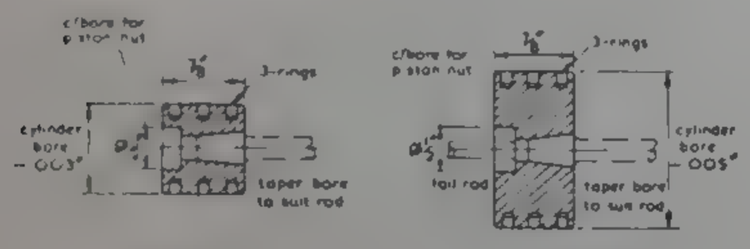
REAR CYLINDER COVER
brs

L P CYLINDER BLOCK
close grained CI or GM



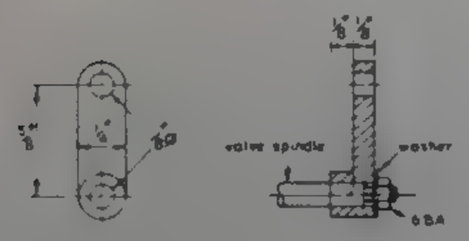
HP FRONT CYLINDER COVER, brs

L P FRONT CYLINDER COVER
brs

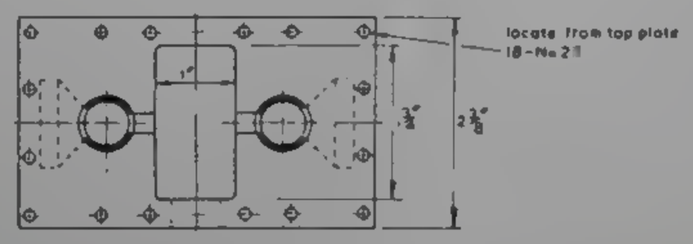


HP PISTON CI

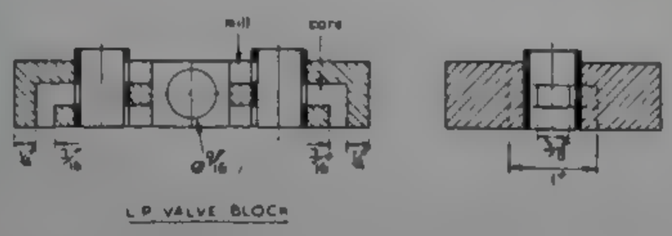
LP PISTON CI



EXHAUST VALVE LEVER brs



All other dims etc as HP valve block (except those shown)



L P VALVE BLOCK

steam spaces or passages. The pistons are best made from cast iron blanks and which are readily available. Each is fitted with three piston rings and again are best purchased as finished articles from model engineers' suppliers. They are bored to fit the rods on a taper. This type of construction greatly increases the frictional grip of piston and rod and in full-size practice the fit is such that the piston has to be driven for the last half inch or so. The angle of taper should not be too large and a wedge type action is sought. A good tightness on the piston nut is then all that should be required. The axial position of the piston on its rod is crucial, since it affects the cylinder clearance on dead centres. The clearance for the engine as drawn for 2½ in. stroke is 1/16 in. end. The piston nut should require no anti-back-off arrangements.

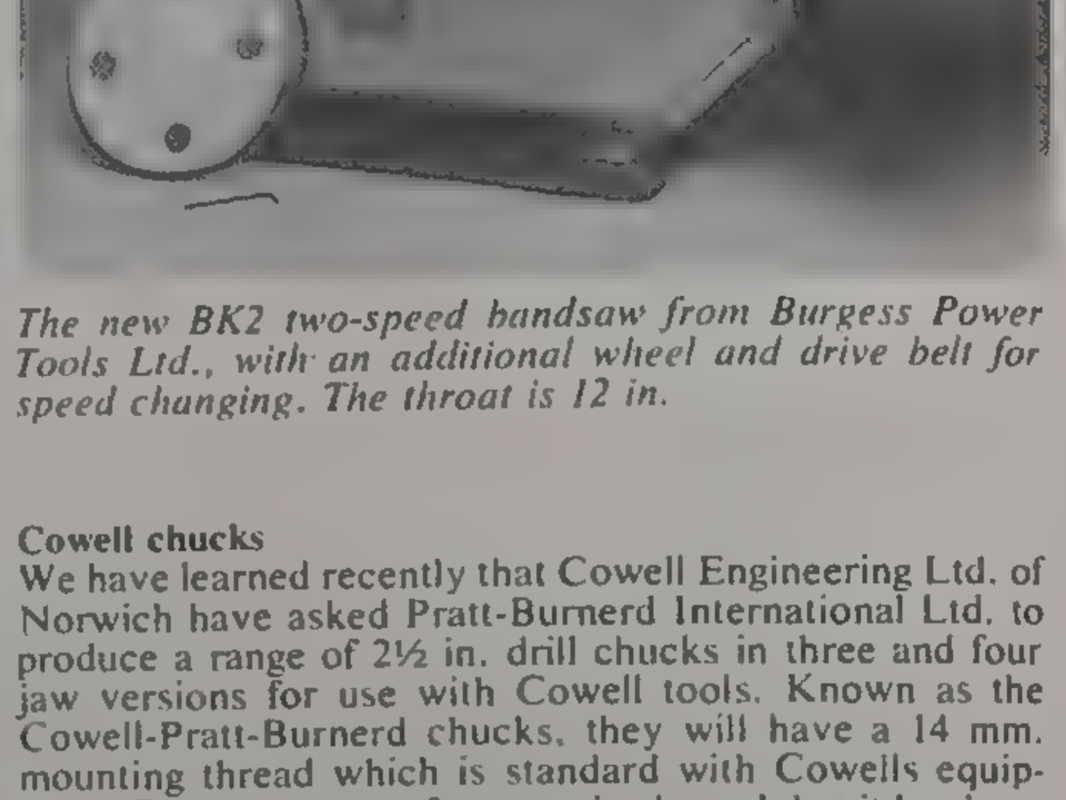
To be continued

WHAT'S IN STORE

Where possible, the items reviewed are seen and tested by "M.E." staff. However, where this is not possible reviews are given solely on the information received from the manufacturers and we cannot accept responsibility for products which do not measure up to the claims made for them.

New from Holts

Take a look around about now for a series of new products just released from Holt Lloyd International Ltd. — that's the name, by the way, of the company formed by the merger of Holt Products Ltd. and Lloyds Industries Ltd. about two years ago. The image which the company has in car care is already known but in the household market the products require some introduction. To the model engineer these latest materials will have some purpose and it is good to note that they will be available in hardware stores as well as car accessory shops. First is another cyanoacrylate. Before the cry goes up "not another", let me explain that this one has been somewhat modified to give a bit longer dwell time. Although "Bond-It" will cure in about 30 seconds this is an improvement over those that leave hardly any time for positioning. It just depends on the application. The second product is "Contour", a filler paste which has received just attention from the manufacturers to eliminate the problem of air bubbles. Although it is a two-part mix, and so air can still get in, the pastes in each tube should be bubble-free. Contour will stick to almost anything for mending cracks etc., so should find a ready market. There is also "Colour-Cut", a liquid developed to restore the original colour to paintwork by removing oxidation.



The new BK2 two-speed bandsaw from Burgess Power Tools Ltd., with an additional wheel and drive belt for speed changing. The throat is 12 in.

Cowell chucks

We have learned recently that Cowell Engineering Ltd. of Norwich have asked Pratt-Burnerd International Ltd. to produce a range of 2½ in. drill chucks in three and four jaw versions for use with Cowell tools. Known as the Cowell-Pratt-Burnerd chucks, they will have a 14 mm. mounting thread which is standard with Cowells equipment. The company, of course, is pleased that it has been able to increase its range of accessories without purchasing outside the U.K. They have also purchased the entire stock and drawings of instrument/watchmaker lathes from I.M.E. Engineering Co. Ltd., and will continue to provide the lathe "in the foreseeable future". For a price list of I.M.E. tools, contact Cowell Engineering Ltd., at Oak Street, Norwich, Norfolk.

The new 'A' range of screwdrivers for slotted and recessed head screws recently introduced by J. Stead & Co. Ltd.

Hot Air Engine

We had a visit from John and Clyde Griffin of Solar Engines the other day complete with one of their Stirling engines which have been advertised recently in *M.E.* It did not take long to fill the burner well with meths. and set the motor running. Maybe the engines at the M.E. Exhibition did turn out more power but after all, that is what the competition is for. However, for simplicity, ease of operation, and, importantly, as a source of education to learn something about hot air engines, this model was a treat. Many parents are reluctant to give steam engines to their offspring because of the boiler problems but they don't occur with this type of engine. Speed control is arranged by bleeding off the expanding air. The model is well-finished complete with stanchions and for $31.00 you receive an engine, owner's handbook, and a 128-page book on the operation of Stirling engines. We hope to let Professor Chaddock measure the output and will report later. Unfortunately at present there is no retail outlet in the U.K. but Solar Engines are working on that.

Considerable development has gone into the Dual-Panamech Spacer Coupling by Powder Couplings Ltd. It is a one-piece unit designed to cater for wide drive misalignment and is available up to 12 in. long. The longer the coupling, the greater the deflection possible.

'EVENING STAR'
A 3½ in. gauge British Railways 2-10-0 locomotive
described by Martin Evans

BEFORE WE CAN START on the tender for *Evening Star*, there are a few final details of the engine to be dealt with. First, the fire-door. This is of the sliding type, and is a fairly close copy of the full-size version, though inevitably somewhat out of scale, due to the larger firehole we require on a ¾ in. scale model.

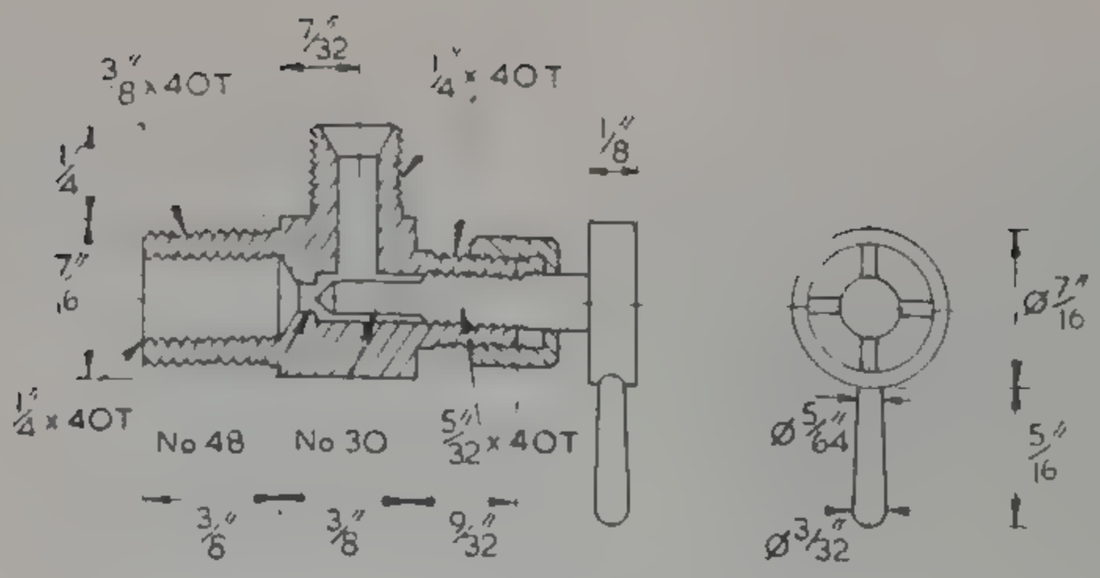
The runners are made from 3/16 in. square brass; this is first reduced to 3/16 in. x 5/32 in., by milling or filing, then it is grooved 1/16 in. wide to a depth of 3/32 in. Note that the grooves should not extend quite to the ends of the runners, so as not to break into the fixing holes. Note also that one side of the channel so formed in the lower runner is removed for the length of the firehole, so that ashes will not collect here and foul the doors. 8 BA screws are used to bolt the runners to the boiler backhead, and they should preferably be of gunmetal or phosphor-bronze.

The doors are from 1/16 in. sheet metal. Mild steel, brass or stainless steel are all suitable, but the last mentioned is certainly to be preferred if builders are fortunate enough to have some of the right thickness. Make sure that the doors slide easily in their runners. The two extensions which carry the pivot pins for the door levers are best made of brass and silver-soldered to the lower runner before this is bolted to the backhead.

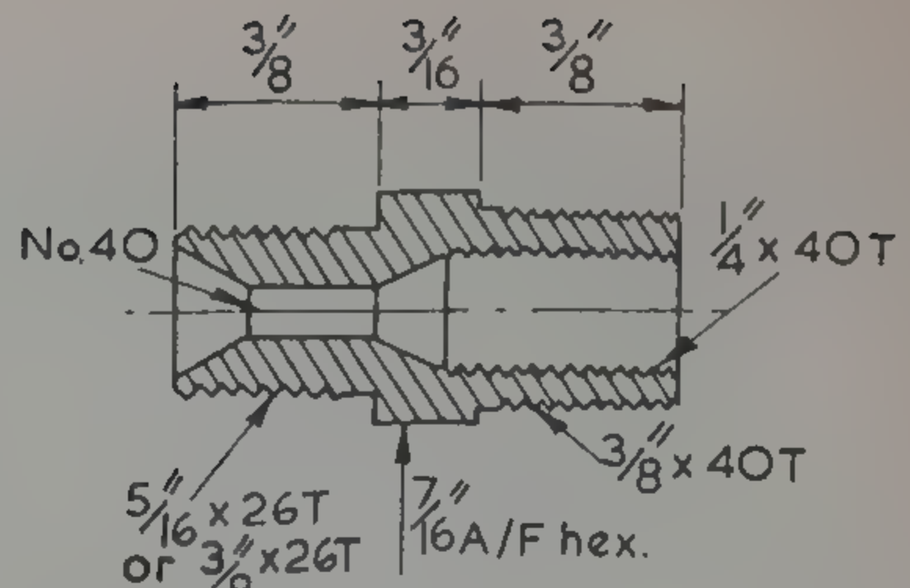
The three levers are quite straightforward and can also be in any of the three metals mentioned above.

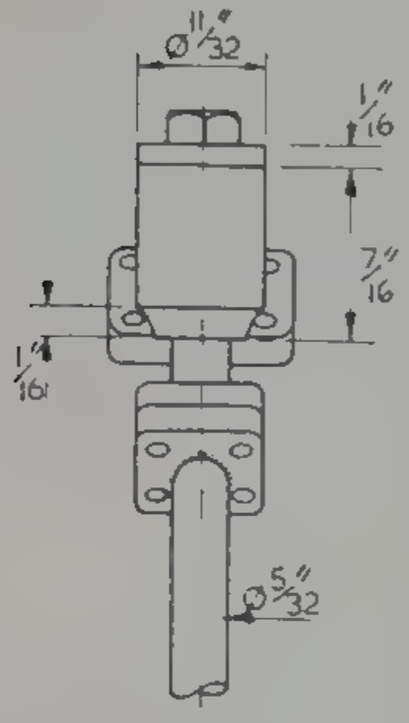
I need hardly say anything about the blower valve, as this is as described for most locomotives of 3½ in. or 5 in. gauge. It is threaded ⅜ in. x 40T externally and ¼ in. x 40T internally, to suit the hollow blower stay. At the smokebox end, the usual union fitting is used, but it might be a good plan to forsake the usual 40 thread here, for the attachment of the blower pipe, and use one 5/16 in. x 26T or if the builder is using a 3/16 in. dia. pipe, for the twin blower required for the double chimney, the thread could be ⅜ in. x 26T. The coarser thread will be found easier to deal with in the confined space in the smokebox, especially as in this locomotive the smokebox tubeplate is situated rather a long way from the door!

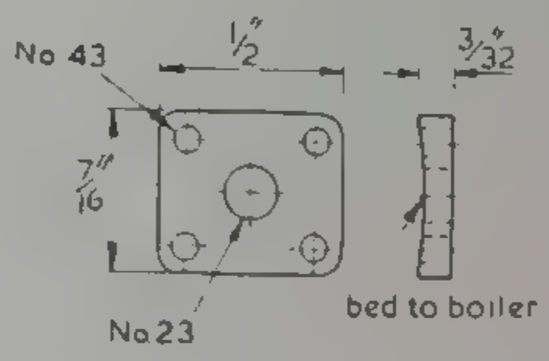
The check or clack valves are somewhat different to the usual type, as they bolt on to the outside of the barrel, by means of a rectangular flange and four hex-head screws — again gunmetal if possible. Care should be taken to shape the flange to a good fit against the barrel, and a Hallite or Walkerite



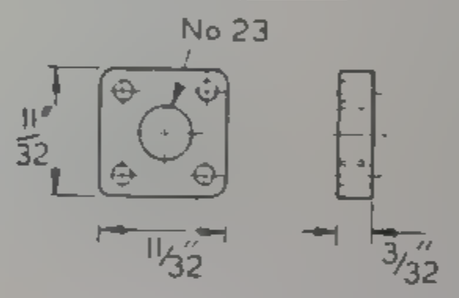
BLOWER VALVE: body gunmetal pin st.steel (X2)





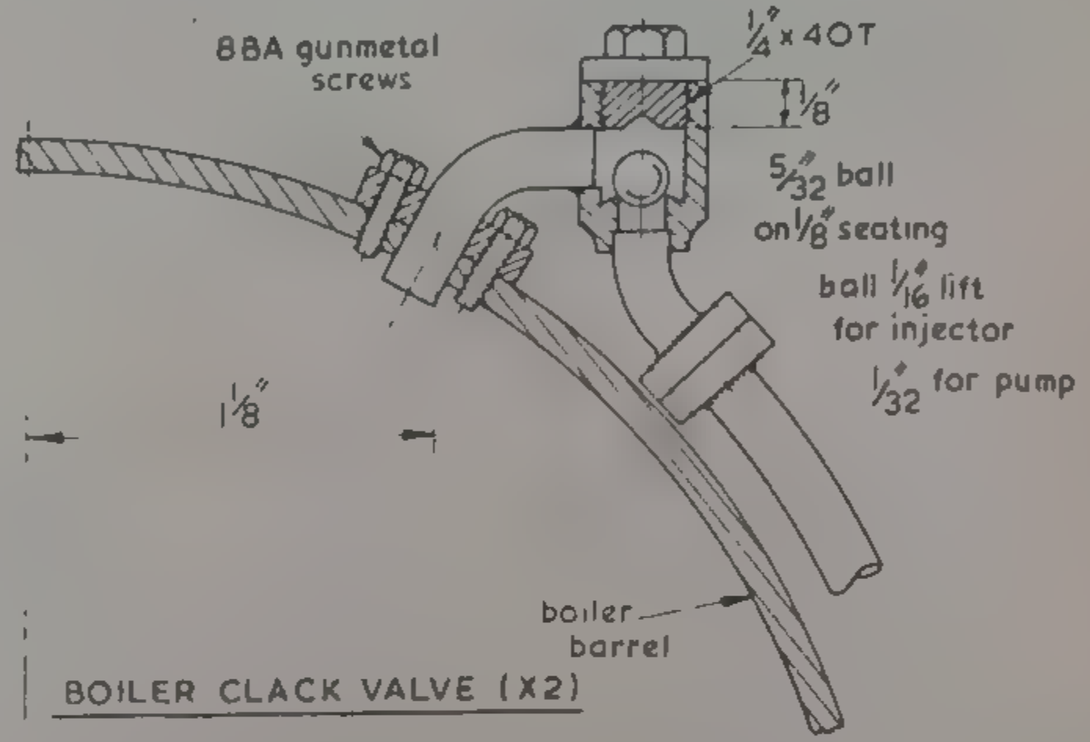


BOILER FLANGE

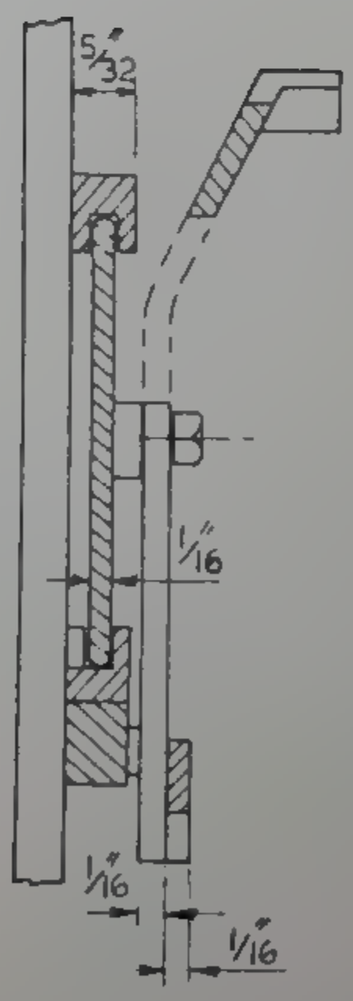


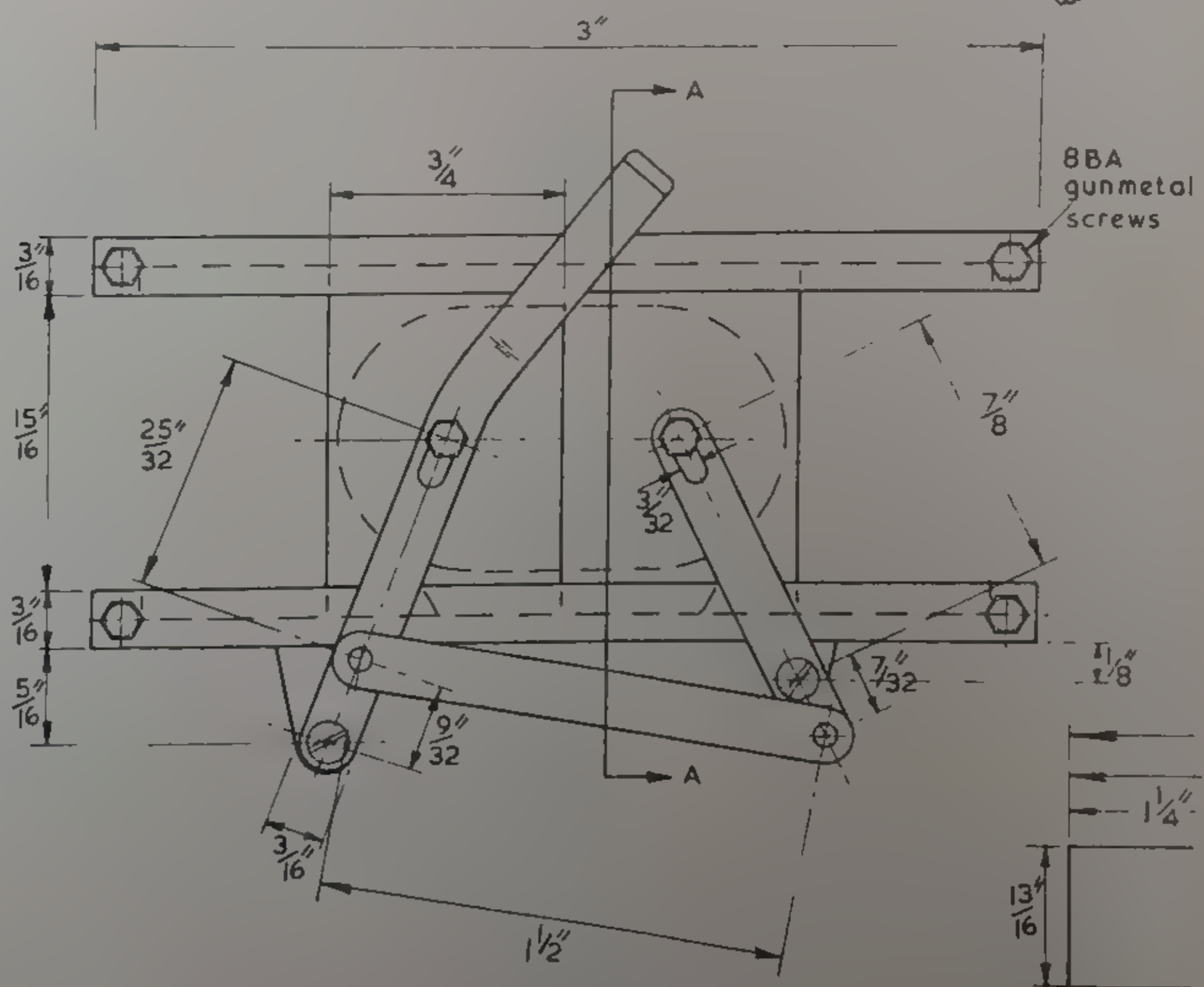
PIPE FLANGES: upper tap 10BA
(X2) lower drill No.50

BLOWER UNION: for smokebox tubeplate.
(X2)



BOILER CLACK VALVE (X2)





DETAILS OF FIRE DOOR (X2)

gasket will be required to ensure steam-tightness. The feed pipes are fitted by further flanges held together by four 10 BA screws.

The Tender

The tenders fitted to the British Railways standard locomotives were very different to any of those built by the pre-nationalised railways. Unfortunately for us, they are rather more difficult to build. This is mainly because instead of the usual flat floor or baseplate, the tank is built up with radiused corners, and the coal bunker is a sort of hopper made separately and fitted into the water tank, projecting well above it. The fireman's shovelling plate extends well forward into the engine cab, so as to enable the fireman to keep well clear of the gap between the engine and the tender, there being no "fall-plate".

The brake handle is mounted horizontally, with the screw spindle sloping slightly, so that the brake cross-shaft can be arranged well clear of the front wheels. However, on our model we can make a small modification to the brake handle, putting it at a slight angle to the horizontal, and at 90 deg. to the spindle, so that we can use a standard pair of bevel wheels as Reeves supply for the cab reverser. The difference will be hardly noticeable.

My drawings show the general arrangement of the tender, and detail drawings of the frames, wheels, axles and axleboxes will follow in the next and final article on *Evening Star*. However, it may not be a bad plan to make a start on the body and fit this to the chassis later on. Incidentally, in my G.A., I have drawn the Timken type axleboxes to exact scale, but those available from Reeves, similar to the "Britannia" type, will be a little wider and my detail drawing will show the Reeves type. This became necessary owing to the ball races being somewhat out of scale on the diameter, no proper taper roller bearings being available in this size, as far as I know.

The tender body is made from 18 s.w.g. sheet brass (1.2 mm.). The base is a separate piece, the radiused bottom edges of the sides being riveted or welded (in the full-size tender) on top of the base. This is most fortunate for us, as it means that we do not have to bend the base and sides all in one piece. I notice that in LBSC's description of his "Britannia" tender, he seemed to be under the impression that the sides and base were in one piece in the prototype tender, and suggested that in the model, a break could be made along the middle of the bottom. But this is not so, as the official drawings (kindly provided by Geoff Cashmore) show the construction clearly.

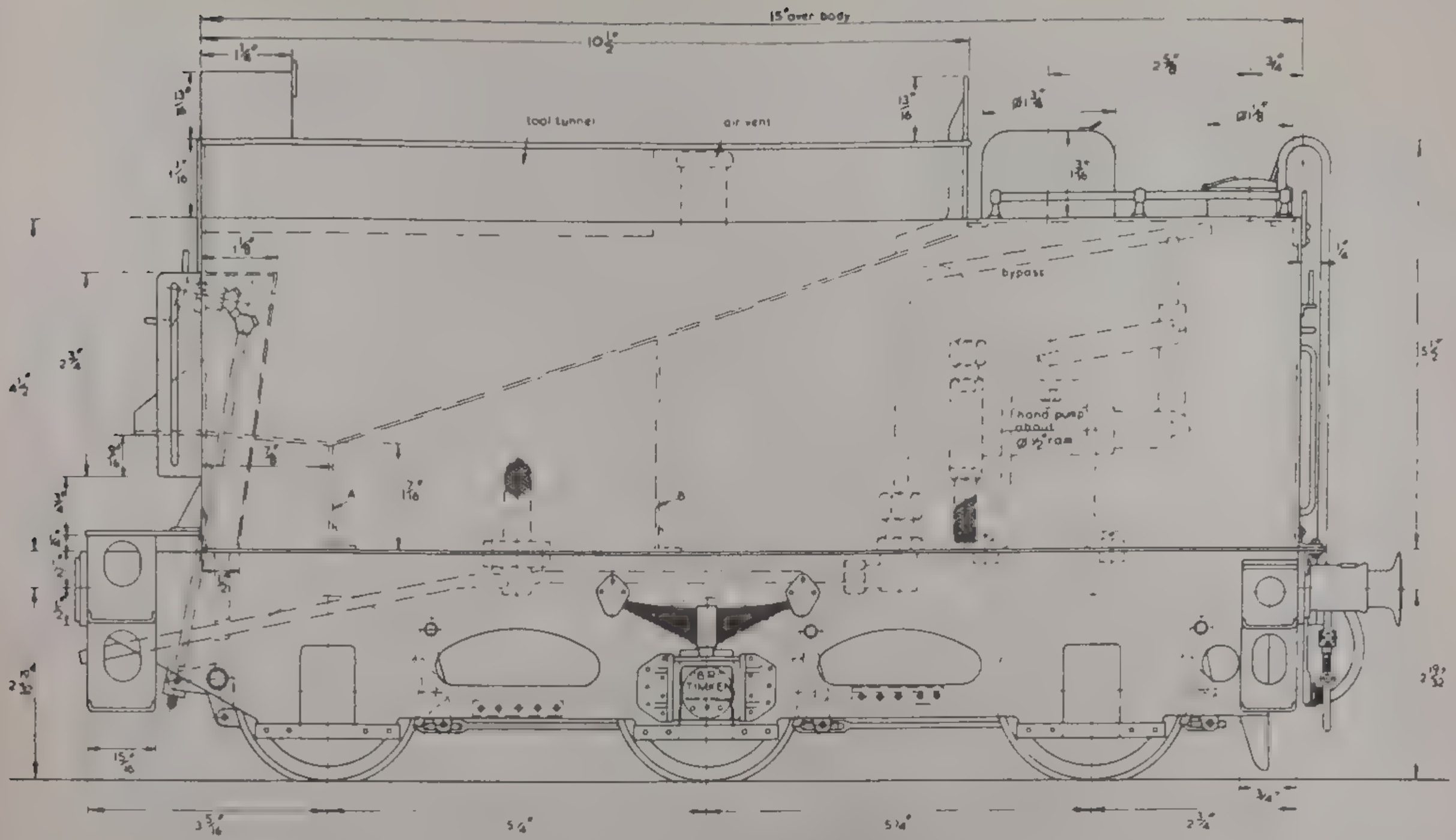
The sides could be riveted and soft soldered to the base, as the overlap "in the flat" is a good ¼ in. In my drawing, it is impossible to see this overlap as it is exactly hidden by the angle bolting the body to the buffer beam.

The back of the tender body can be fitted to the sides in the usual way, by brass angle ¼ in. or 5/16 in. and a few copper rivets, countersunk and filed flush and the whole soft soldered to make the tank water-tight.

The sloping coal plate will need some support in the middle, so two "bulkheads" are shown. The one I have marked A must be solid and soft soldered all around, as it forms the front of the water space, but the bulkhead marked B will require several holes drilled in it, near the bottom, to allow the water to reach the front of the tank. Three or four of ⅛ in. dia. should suffice, and this bulkhead will help to prevent surging if an emergency stop has to be made!

I have shown the usual hand pump, and this is set rather higher than usual so as to reduce the stroke of the handle to reasonable proportions. Even so, it will be necessary to cut quite a long slot in the top deck. However, I think a much better way is to make the whole of the top deck, complete with the water pick-up dome and water filler, removable, apart from a "border" of ¼ in. brass angle, which is required to support it. It may be argued that the ladder will prevent this top deck from lifting, but we could get over this by ending the extreme end of the ladder a short distance from the deck, securing it by an additional bracket (not shown in the drawing)

Photos by courtesy of British Rail/Oxford Publishing Co.



TENDER FOR EVENING STAR

PLAN OF TENDER BODY

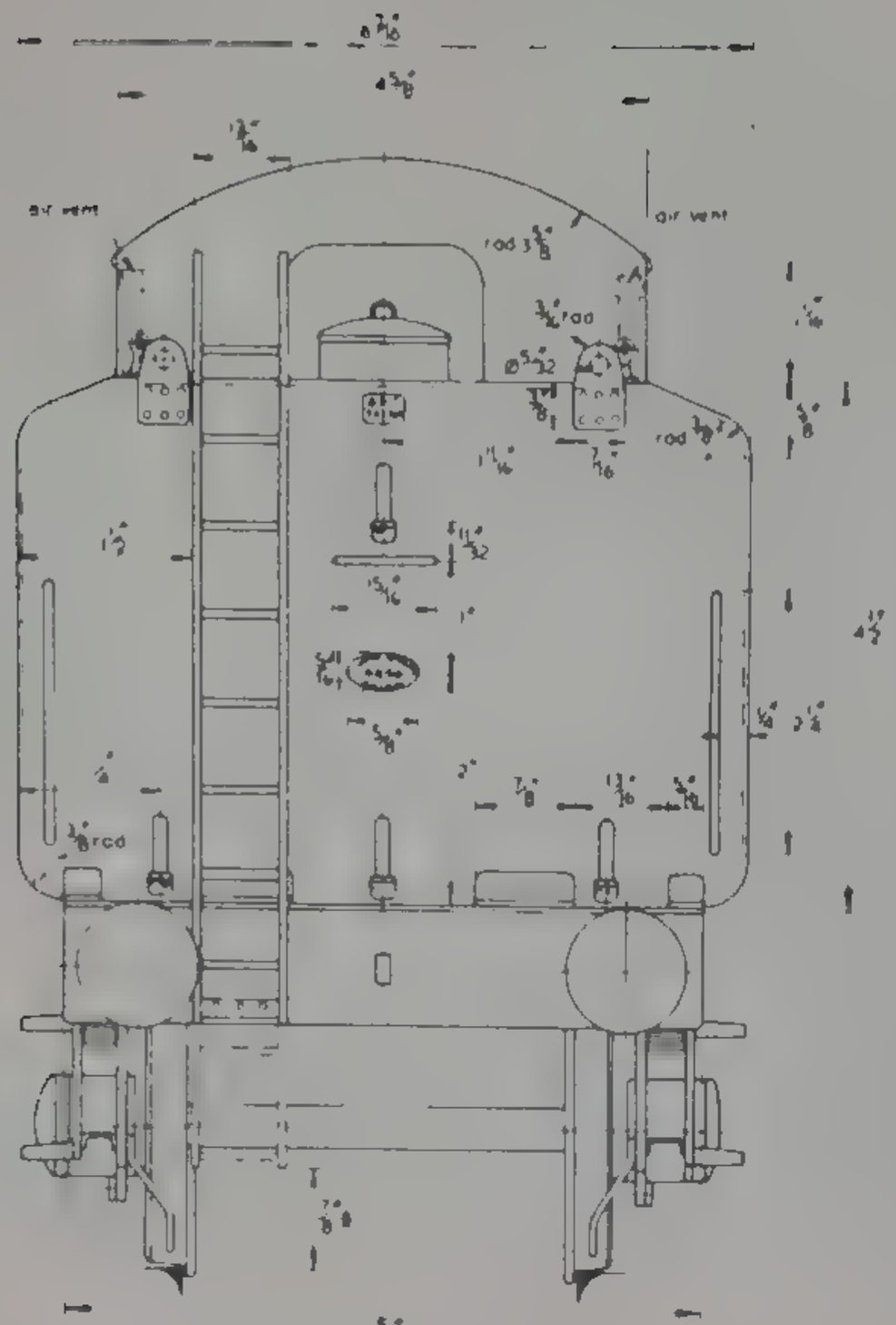
(steps omitted)

riveted to the top edge of the back of the tender.

Incidentally, as tender hand pumps are really only provided for emergency use (as injectors are more reliable nowadays), perhaps it would be sensible not to screw this top deck down at all, but to rely on dowels or some kind of spring clips to hold it in place, so that it can be lifted off immediately the pump is required. Needless to say, a good deep filter should be let into the water filler, again easily removable.

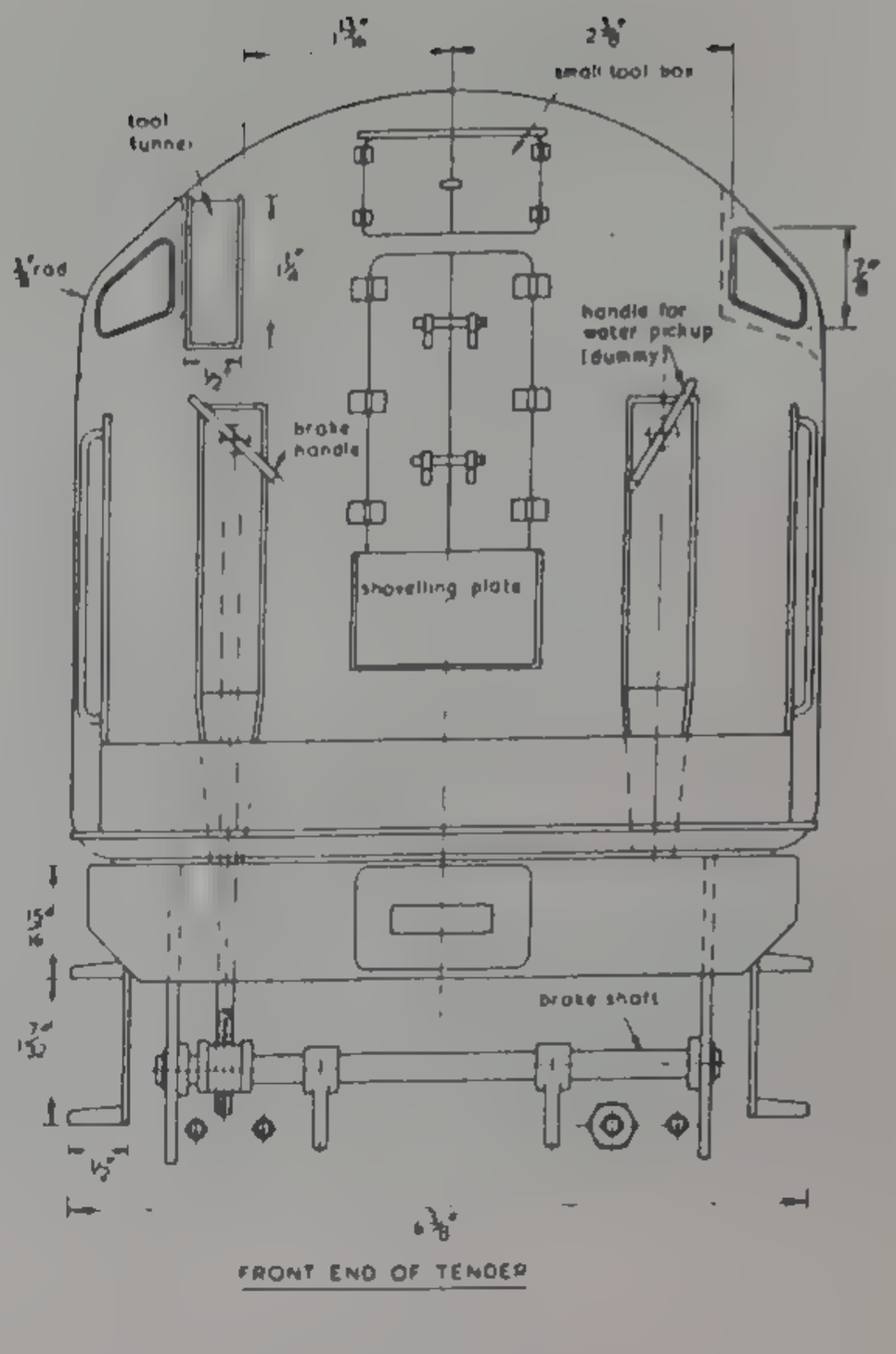
On the top of the coal bunker, we have (on the right-hand side only) what was officially described as the tool tunnel. This was presumably for the shovel and prickers, etc. The recesses for the brake spindle, bearing and gears may present a bit of a problem. The best way to deal with this, and for the similar arrangement on the left-hand side, where the (dummy) handle and spindle for the water pick-up gear is situated, is to make the whole affair as a separate unit, then cut a slot in the tender front plate to receive it, measuring "on the job". I will show a separate drawing of the brake arrangement next time, which should make matters clear.

On page 394 of the 7 April issue, I described a



REAR END OF TENDER

(on some tenders ladder ends at base of body)



FRONT END OF TENDER

method of ensuring that the threads of the "wet header" lined up correctly with the threads in the smokebox tubeplate bush, and suggested that if the main steam pipe was shifted slightly in relation to the regulator body (by turning it one way or the other) the problem would be solved. But I had forgotten that if the threads at the regulator end of the main steam pipe were the same pitch as those of the header and its bush, this adjustment would have no effect whatever (as more than one reader has reminded me!) However, if the main steam pipe is threaded, say, 40T, where it screws into the regulator body, with 32T used for the header and its bush, all will be well.

But I have since thought of a much easier way to get these threads to line up properly. All we have to do is to file the holes in the boiler barrel used for the screws which hold the regulator body to the barrel, slightly oval (in a "fore-and-aft" direction). Then the regulator body can be shifted one way or the other, with the fixing screws slackened, until the threads engage properly. This applies to slide valve and Stroudley type regulators. If the regulator is of the "disc-in-a-tube" type (a type I do not now recommend), the same idea can be used, simply by varying the thickness of the gasket at the backhead flange, which of course has the same effect, moving the whole regulator slightly one way or the other.

The method used by Mr. Holmes, incorporating an "O" ring, instead of the inside-and-outside threads, may be perfectly sound, but it does involve the modest staying effect (for the smokebox tubeplate) being lost. The disc-in-a-tube regulator has the slight advantage that it stays the smokebox tubeplate and the backhead to some extent. But it is a difficult one to remove, should the valve stick on the port face — a not unknown happening!

To be concluded

DIVIDING AND DIVISION PLATES

By Geo. H. Thomas

IN LOOKING THROUGH the file of readers' queries which have been answered over the past two or three years I find that a large proportion of them is of the type involving simple calculations such as those concerned with the setting up of gear trains for screw-cutting; the making and use of thread dial indicators (I remember the one for a lathe with a 9 t.p.i. leadscrew!) and problems connected with worm and wheel dividing. The first two of these will be covered very fully later on and the last one I propose to deal with now even though I am currently working on a small dividing head having alternative direct or worm-and-wheel facilities which I hope to describe in detail as soon as it is finished.

In industry a "dividing head" is generally used in conjunction with a milling machine and it might be "plain" or, for use on a universal miller, it might embody means for spiral (more correctly, helical) milling and indexing which usually goes hand-in-hand with "differential indexing" by means of which large prime numbers can be obtained. For the amateur, the term has a wider context; it could be a simple form of the industrial "plain" head for use on a small milling machine table or on a vertical slide, like the Myford Dividing attachment. It might be an attachment which is coupled to the mandrel of a lathe for the purpose of carrying out dividing operations on work held, usually, in the chuck. The form which this takes will depend, to a large extent, on the design of the lathe and the facilities available for mounting the device on it. Arrangements of this kind are ideal for dividing micrometer collars, protractor scales etc. using some form of engraving tool on the slide-rest, but for gear-cutting and general milling work they require the use of a separate milling spindle driven by its own motor or from an overhead gear.

There are three possible areas for attachment; (a) by mounting the worm-wheel on the tail-end of the mandrel with the worm and its bracket attached to the left-hand end of the headstock — usually difficult to arrange with most modern lathes though it is perfectly feasible with the old 3½ in. Drummond (or Myford "M") lathe. (b) A complete dividing attachment, either commercial or home-made, can

be plugged into the back end of the mandrel and made to grip in the bore by means of an expanding plug. The possible disadvantages of this arrangement arise from the difficulty in getting a really rigid anchorage for the bracket and to the fact that the drive is by friction on a relatively small diameter. In the third system (c) the bull-wheel is utilized as the worm-wheel which leaves only the worm bracket to be attached and, provided the bull-wheel is accurately made with the pitch-circle concentric with the bore (which is only fair and reasonable to expect — but expectations are not always realised!), and the number of teeth in the wheel is "convenient", this is probably the best arrangement. I have been reminded that Drummond Bros. once listed a dividing attachment of this kind which fitted to the headstock in place of the C.I. guard over the bull-wheel on the 3½ in. lathe and I well remember the illustration of it in their catalogue.

An excellent example of an attachment of this kind (for the Myford Super-7) was described by the late J. A. Radford (Vol. 134 p. 24) many of which have been made. Photos of my own version of it were shown on p. 1423 of the last volume (16.12.77) and it can be seen in use in a new photograph where a protractor scale is being engraved. At the end of this article I shall describe a few detail modifications to the Radford design but I am concerned here, not so much with dividing attachments, as with division plates and the problems connected with them such as:

1. How do I determine the number of holes required to produce "n" divisions?
2. How many teeth should there be in the worm-wheel?
3. Is there any advantage in using a two-start worm?
4. I am proposing to use a lathe change-wheel as the worm-wheel; shall I be able to get more divisions if I am able to change the size of the wheel?

Most industrial dividing heads, possibly for mechanical design reasons, use a 40T worm-wheel and a few have used a 60:1 ratio. The "Senior" head and the "Boxford" dividing attachment are 40:1, the "Senior" having 80T and a 2-start worm. The Myford attachment is 60:1. The reason for the choice of either 40 or 60 will be clear a little later but a worm-wheel having *any* number of teeth *can* be used; the only effect of using a wheel having an unusual, even a prime, number of teeth is to limit the number of different divisions obtainable from any given circle of holes. If we have a 40T worm-wheel and turn the mating worm through exactly five turns we shall cause the wheel to move through five teeth or one-eighth of a complete turn, so we can do some dividing by means of whole turns of the worm without using the holes in the division plate.

The number of different divisions which can be obtained will depend upon the factors of the wheel. Thus, a 40T wheel has prime factors 2, 2, 2, 5 which, singly or in combination, give the factors 2, 4, 5, 8, 10, 20, 40, all of which are aliquot parts and are the seven different divisions which can be obtained from a 40T wheel using complete turns of the worm. It will be clear that a number which contains factors other than those in the wheel cannot be obtained by whole turns. 30, for instance, contains the prime factor 3 which is not in the wheel so we have to provide other means — the circle of holes — which must contain the missing factor or factors. The rule for determining the number of turns of the worm, complete or partial, is very simple:

$$\text{Turns of the worm} = \frac{\text{Teeth in the worm-wheel}}{\text{Number of divisions required}}$$

Applying this rule to our problem of 30 divisions we have: turns equals 40 divided by 30, equals 4/3 or one and one-third turns from which it is clear that the circle of holes must be a multiple of 3. If it were 27, for instance, we would turn the handle once and then a further nine holes from its starting point. It is fundamental that prime numbers cannot be generated by plain indexing, they must all be present in either the worm-wheel or the hole circle. Thus, our 30 divisions breaks down into the primes 2 x 3 x 5 and of these, 2 and 5 were in the wheel and 3 was in the circle. I tend to regard the plate as the source of the larger primes, the worm-wheel providing the necessary multipliers — the small primes — and for this reason I prefer the 60T worm-wheel to the more usual 40. In the 60T one of the twos is exchanged for a three and the prime factors of 60, i.e. 2, 2, 3, 5 provide eleven different multiplying factors as follows: 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60 as compared with the seven for a 40T.

There are two methods by which large primes can be accurately generated; one, by differential indexing, which involves the use of a special dividing head in which the index plate is geared to the driven spindle of the head and can be made to revolve one or more turns in either direction whilst the spindle makes one turn, which has the effect of adding or subtracting a small number, depending on the turns of the plate, from the divisions which would have been produced. Thus, if the plate turns forward once for each turn of the spindle, the indexing arm will have to travel further each time to meet the required hole in the circle and, in the end, the number of divisions obtained will be one fewer than if the plate had stood still. This method gives exact results.

Another method is by "Compound Indexing" in which the arm is moved forward by a certain

number of holes in one circle and then the plate, together with the arm, is moved forward or backwards by a given number of holes in another circle. The equipment for this is simpler and is well within the capabilities of many home workers — it requires only a few frills added to an ordinary head plus a lot of arithmetic of a somewhat trial and error nature. A drawback is that it is not so comprehensive as the differential method and many of the possible numbers of divisions are approximations, but *very* close ones, quite suitable for gear-cutting. "Machinery's Handbook" gives a table for compound indexing all numbers from 51 to 250 but these apply to a 40:1 head.

A third and rather doubtful method uses approximations in a similar manner to that described in my article on cross-slide micrometer collars (p. 26). I wanted 9/1000 of a turn for each line on the vernier scale and it was obtained by taking 20 holes on a 37 circle which, with a 60T wheel, gave divisions accurate to one part in 1000 which, for the application, was quite accurate enough but it would not have been good enough for gear-cutting because all one's sins catch up at the end. Had I been cutting a wheel about 2 in. diameter, the last tooth would have been 6 thous thin. Such "gears" are, however, perfectly good for use as count-wheels which would act in the same manner as the templates which will be described.

How many different divisions can be obtained from a given wheel-ratio and hole circle? Although this information is essential for determining the usefulness or otherwise of a given combination, it is a matter that I have never seen mentioned in a textbook or elsewhere. All that we need to do is to multiply every factor in the wheel by every factor in the hole circle and this is best done in the following manner. Set out the factors of the wheel starting from one and then, below one set out vertically the factors for the hole circle. Next multiply at all intersections as shown below which is a chart for all the 31 divisions obtainable from a 40T wheel and a 77 hole circle.

1	2	4	5	8	10	20	40
7	14	28	35	56	70	140	280
11	22	44	55	88	110	220	440
77	154	308	385	616	770	1540	3080

I imagine that it will now be clear to readers why 40 and 60 are regarded as desirable ratios for the worm and wheel rather than "odd" numbers like 65 which I mention particularly because the bull-wheel of the ML7 lathe has 65 teeth and it has been regarded by many people as useless for dividing purposes. This is true only if we are thinking in terms of direct indexing with a plunger engaging the teeth of the wheel; it can however be used in conjunction with a worm but it is not as versatile as the 40 and 60 wheels because it has only two factors, 5 and 13 and 13 would be better obtained from a hole circle rather than be present at every indexing job. Possibly the best way to make this clear is to use the method shown above and compare the results obtained from a 60 wheel using 77 and 78 circles with those from a 65T wheel using the same two circles. I will not take up valuable space with charts of all the combinations but give the results in condensed form as follows: 60T with 77 and 78 circles gives 83 different divisions, 35 of which are less than 66. The 65T wheel with the same two circles gives 35 different divisions, only 16 of which are below 66. I have selected 66 as a limit because numbers up to about 60 or 70 are far more useful and likely to be used than the very high numbers which can be regarded as the "froth" on the top.

A dividing device based on the use of change-wheels in conjunction with a worm and plates does present some interesting possibilities as in this way one can produce a number of divisions which include two largish primes which could never be done with the usual 40 and 60 ratios. If, for example, 221 divisions were required it would not be possible with a standard "plain" dividing head because 221 is the product of 13 and 17 and we cannot have both of these in one plate, unless, indeed, the plate has 221 holes! If a 65T change wheel were used, a circle containing 17 is all that would be necessary because the wheel would provide the 13 factor thus:

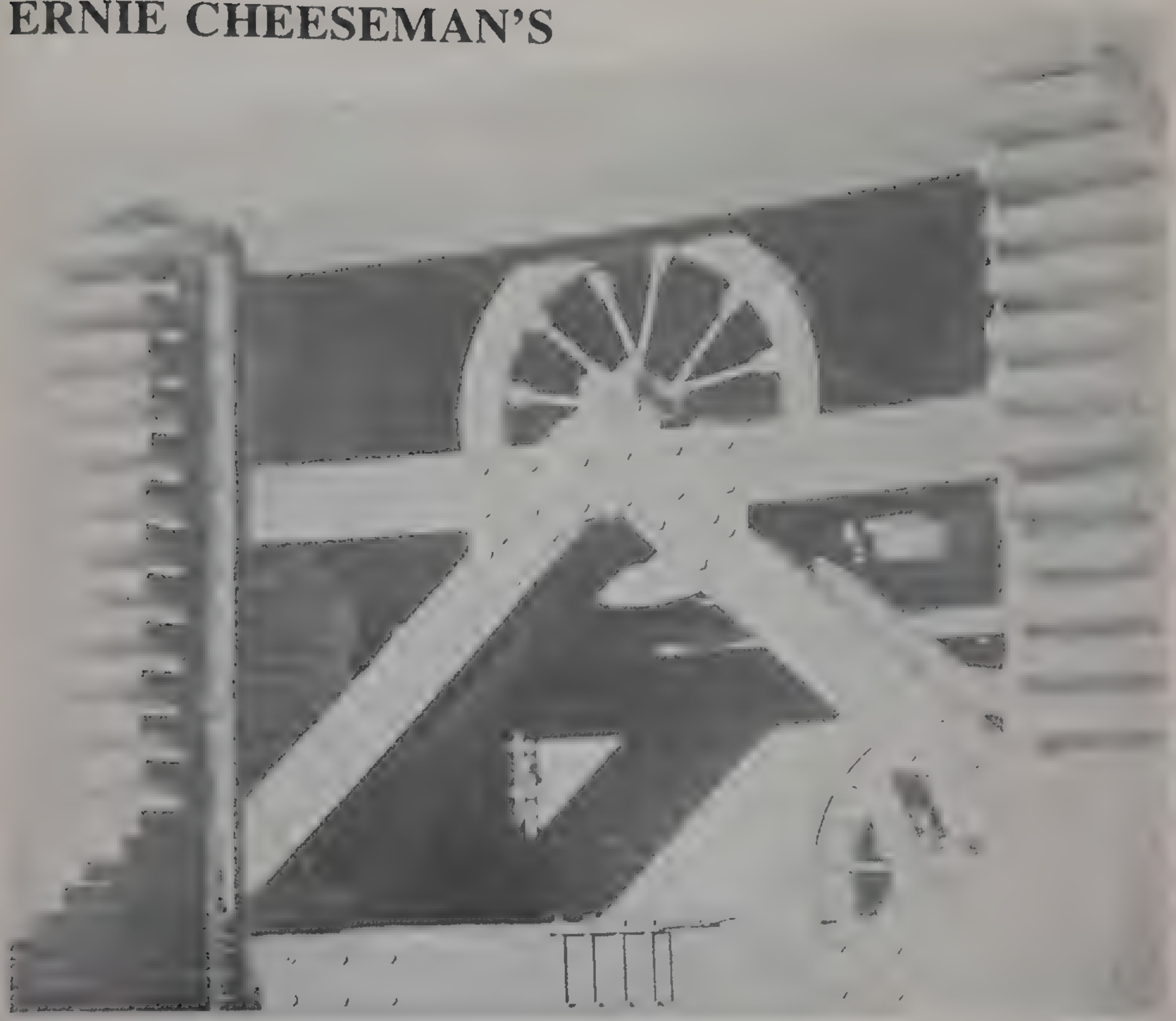
$$\frac{65}{221} = \frac{5 \times 13}{17 \times 13} = \frac{5}{17},$$

so five holes on a 17 circle, or with Myford plates, 10 holes on a 34 circle would give us 21 divisions from a 65T wheel. Similarly, other wheels could be substituted in order to provide different primes. In the issue of 4 Nov. 1977, Martin Cleeve showed a very practical form of dividing head embodying these features but, as illustrated, it did not include the usual form of multi-circle division plates.

What numbers of holes are necessary or desirable on the plates? I recently came across a letter written 25 years ago to *M.E.* in which a reader, writing about a dividing device he had made, mentioned that he had provided circles of 20, 30, 35, 40, 45, 50 and 55 holes and that with these, in conjunction with a 40 to 1 ratio "there are very few divisions which cannot be got". It was obvious from a glance that the numbers contained a wealth of repetitive factors — all of them contained the factor five — and that, in fact, only 22 different divisions were obtainable between 13 and 70 using all seven of the circles! To work out the most useful numbers for the circles of holes is a tiresome exercise and as it has already been done for us we might just as well look at current practice!

To be continued

ERNIE CHEESEMAN'S



HOLMSIDE AND SOUTH MOOR COLLIERY

Part IV

From page 220

ALMOST ALL LARGE diameter rope haulage and hoisting wheels used in the early North East coal mines were of the one basic design (see Fig. 1). The rim with its exceptionally deep rope groove was supported from the hub by round steel spokes (in manufacture these spokes were cast in, and in very large diameter wheels, above a high capacity shaft, these spokes could be as much as two inches in diameter), and were cast in two halves. The Hedley Pit, which is the subject of my project, had no less than 14 such wheels around the surface buildings: two for each shaft, and the other ten associated with the complex rope haulage system.

I have now completed four of them, two for each shaft headstock, these four being a sort of exercise in order to find the easiest and quickest method of production. The remaining ten will now be tackled when I reach their particular building phase.

The rims of these four wheels were turned out of some off-cut pieces of phosphor bronze bushing material. In the case of the larger pair which will be mounted above the main coal shaft, the rims were split after turning the inside profile, but while the outside diameter was still in a rough turned state. Grossly oversized lugs were then silver-soldered to each severed end, and each pair of halves re-joined

NOT TO SCALE

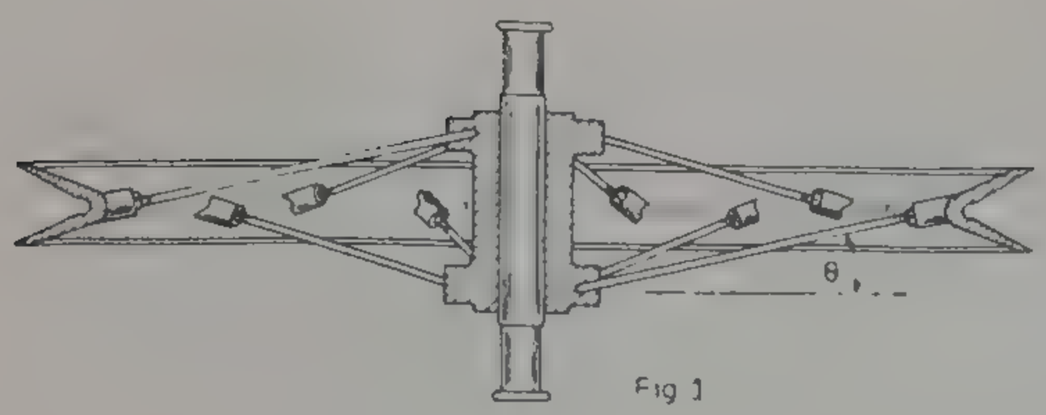


Fig I

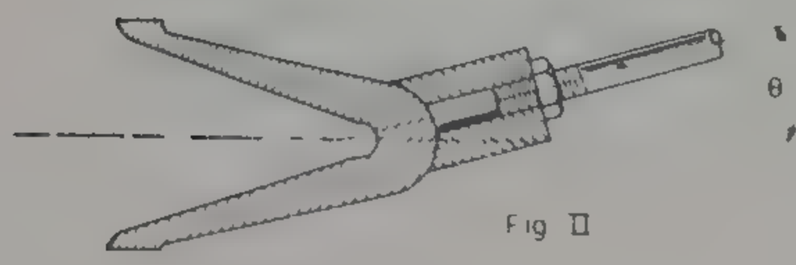


Fig II

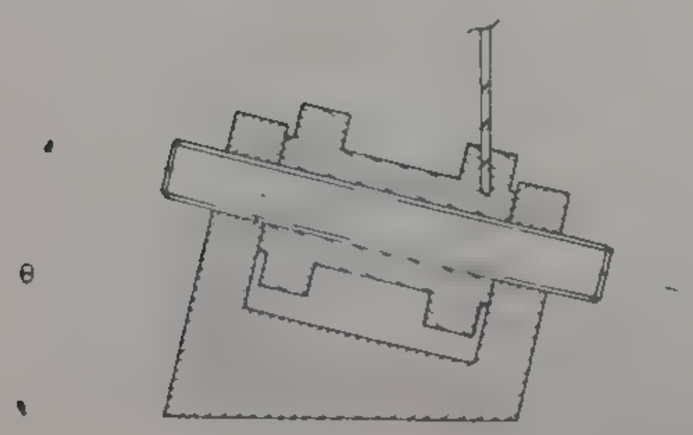


Fig III

by bolts through these lugs, then the outside diameter and rope groove profile were finish turned, and later the lugs were hand whittled to correct dimensions. The smaller were not split, and all four hubs were a straightforward turning and boring job, using round brass stock offcuts.

In order to achieve uniformity of angle and depth when drilling these hubs to take their spokes, two simple jigs were made, one for each size of hub (see Figs. 2 and 3). The angle at which to set the dummy axles was a simple trigonometrical calculation, and need not be repeated here.

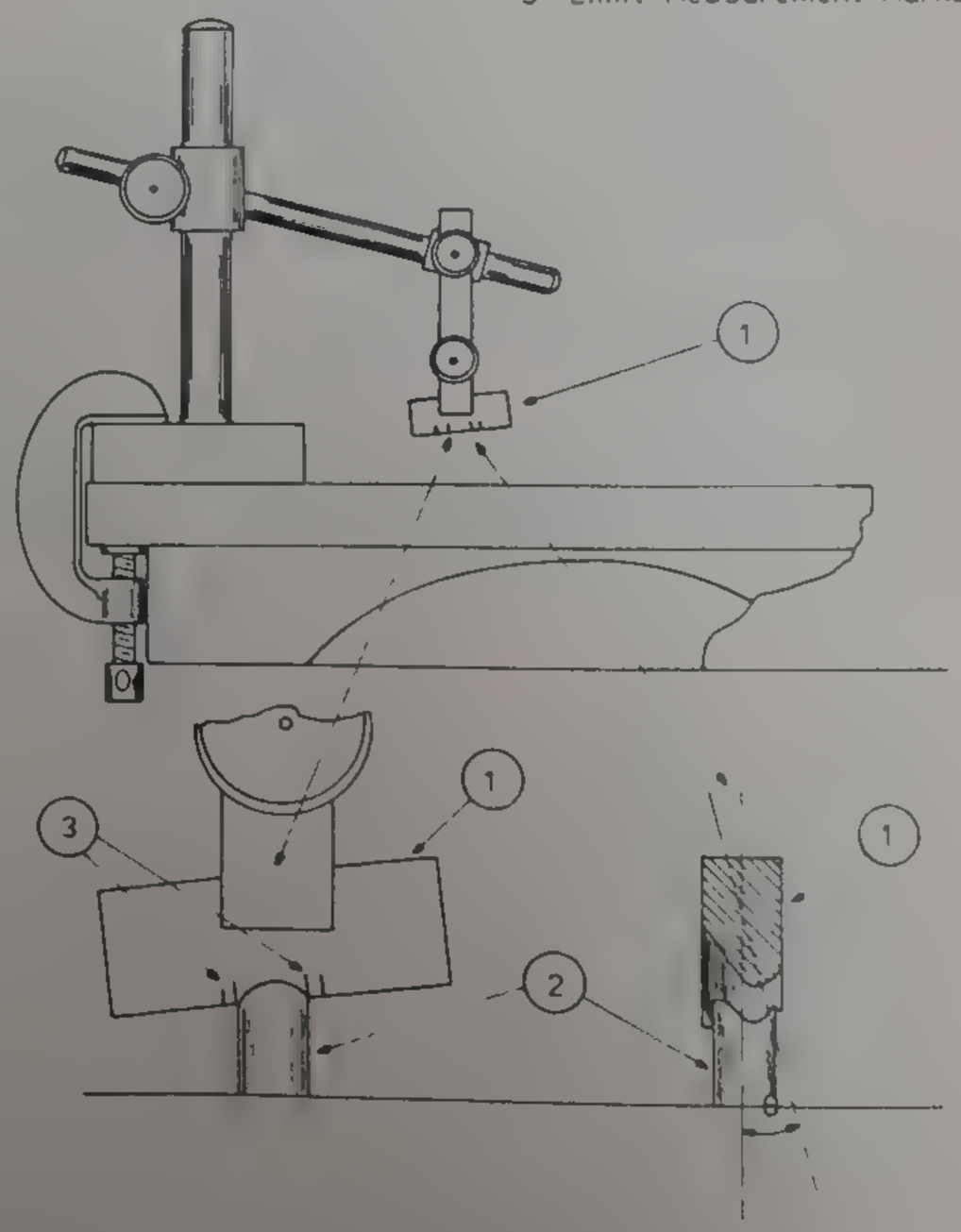
My next job was to produce 96 spokes, each threaded at one end only. I used 1/16 in. round brazing rods for both size wheels, but of course there were two different lengths of spokes. The threading of 16 turns of 10 BA was done in the lathe. Before setting up my tailstock die holder, I first removed the handle, then feeding the 1/16 in. rod through the hollow mandrel and holding it in a three-jaw chuck, with the left hand I held the headstock, and with my right, I slid my palm over the knurled body of the dieholder 16 times, thus producing the required thread: you can do this with only 10 BA threads to cut. Each length after threading was cut off using side cutters, and the rod again fed through the mandrel and chuck, for the next length to receive its thread; the leading end was trimmed up by file before each threading operation.

With two outside micrometers lock set, one to spoke length, and the other three thou wider, I hand filed the dumb end of each spoke to finished length, the two mikes being my GO-NO GO gauge. The respective length spokes were then pushed home into each drilled hub, and the whole soft soldered: a 10 BA nut was then screwed on to each spoke.

Now came the "sticky bit", I had to produce 96 spoke bosses: in the lathe I turned out 96 lengths of 5/32 in. brass bar, each drilled through the centre with a 1/16 in. clearance drill, and these became my basics for producing the spoke bosses. I made a positive profile of the inside diameter of each wheel rim, and clamped this at correct height above my surface plate (MY test jig). Hand whittling then became the order of the day, as I proceeded to file the profiles on the 96 boss ends. Surprisingly, it turned out to be a fairly speedy job, keeping careful check on my hand pressure, and counting the number of file strokes, for each of the three operations needed to produce a reasonable facsimile of the required profile: I found I was getting to within 5 thou of the standard each time: quite good enough, the whole 96 took four hours whittling.

I was now ready for assembly; all spokes on one side of the wheel received their bosses, profiled

1 Positive Profile
2 Rim Spoke Boss
3 Limit Measurement Marks



POSITIVE PROFILE SET AT EXAGGERATED ANGLE

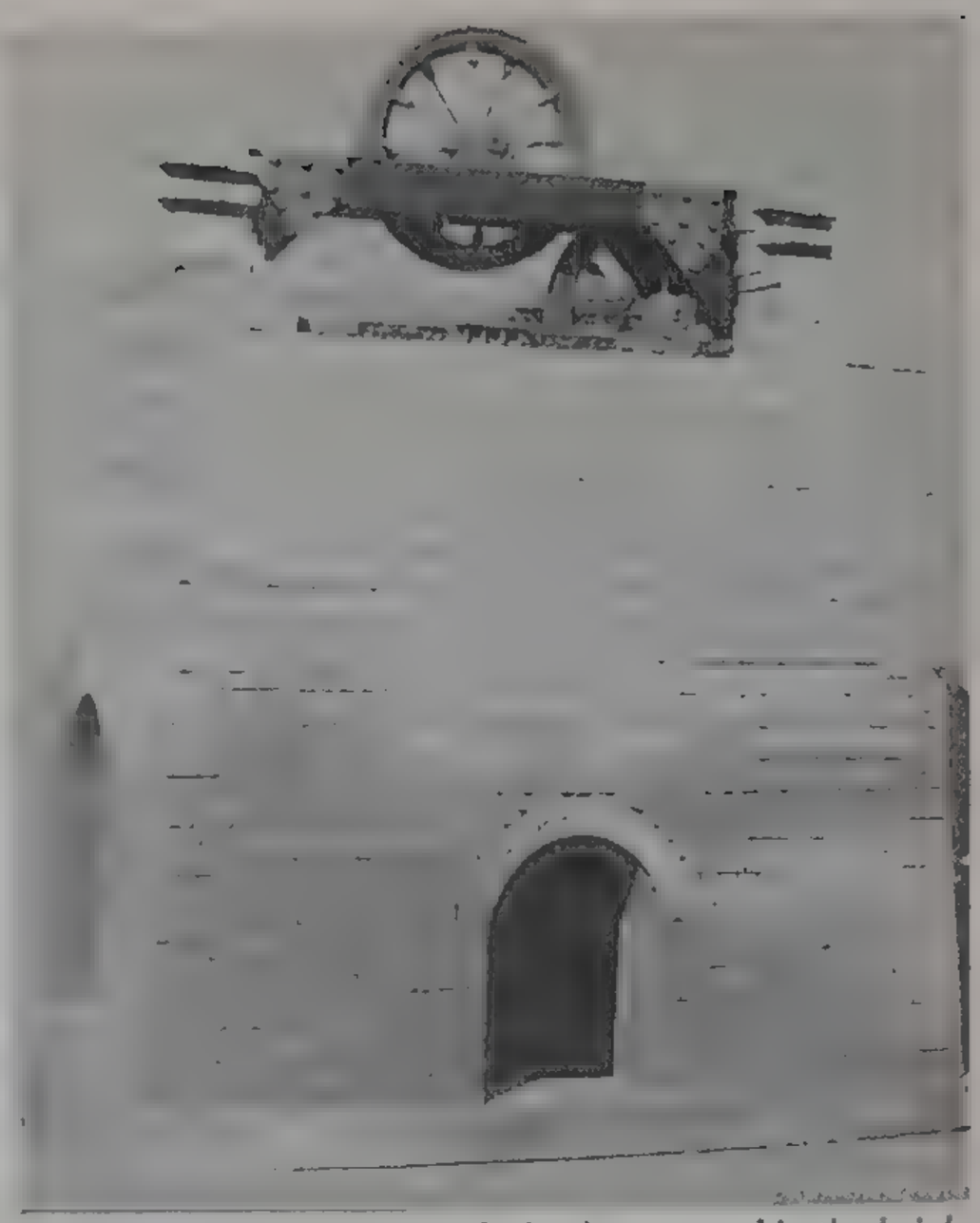
Fig IV

ends outward. After dropping the hub/spoke assembly into a mating ring, the whole was carefully turned over, and with a spot of spoke springing, the other side was bossed up. A couple of unscrewing turns on each spoke nut, and I had a remarkable solid job, even so, I deemed it expedient, after carefully spacing each boss, to soft solder them to the rim; besides the solder filled any tiny gaps at the interface of rim with boss, and after painting, gave the appearance of a casting type continuity.

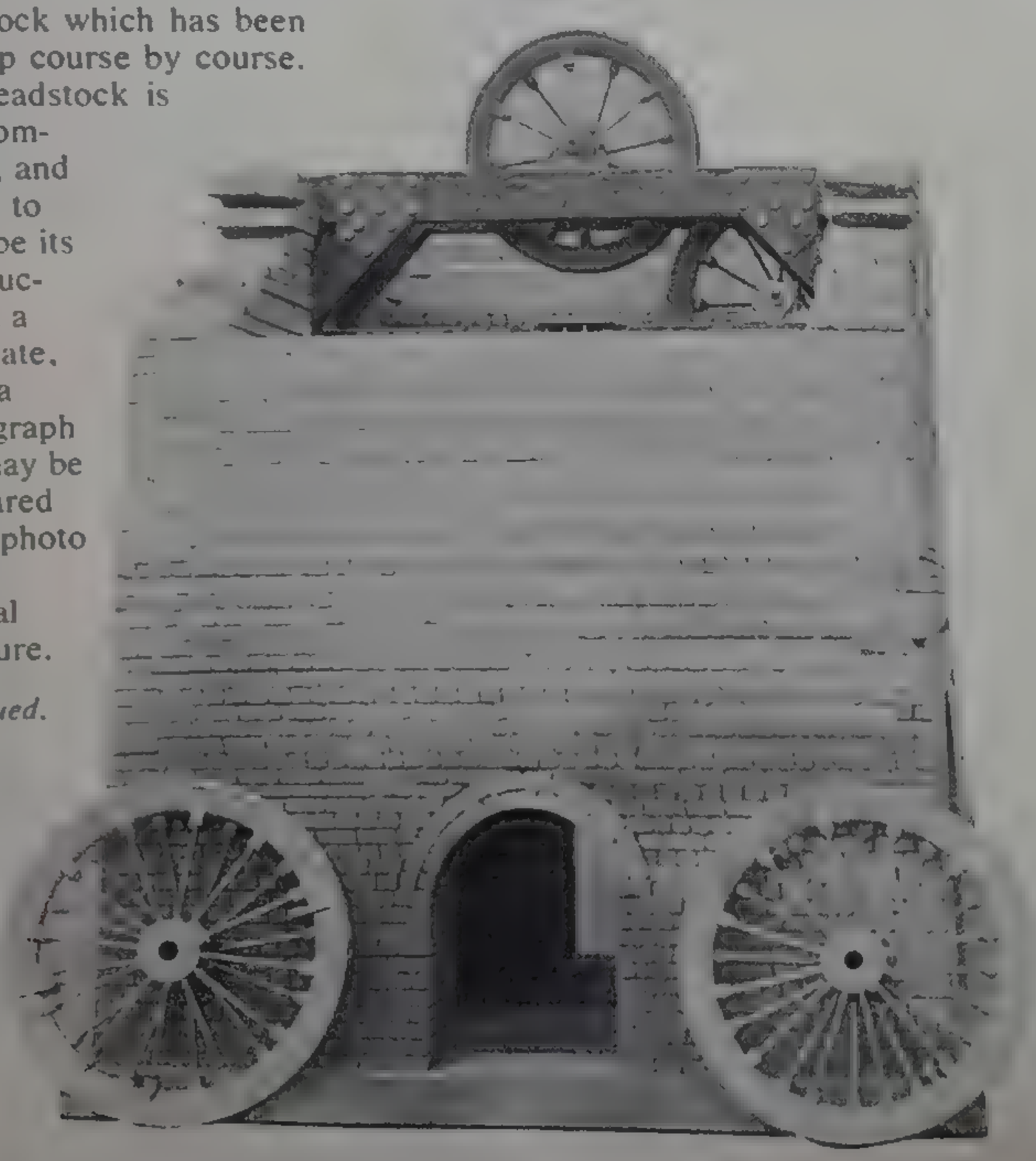
After fitting each wheel with their dead axle, they were trued up between the centres by adjusting the appropriate spoke nuts, "bicycle fashion". "Oh," you say, "that puts the spokes under compression instead of being in tension." Quite so, nevertheless the wheels are a very solid job. So in defence, I would say that in exchange for something which cannot be detected in the finished product, I have gained a colossal saving in time: and I have still to do ten more wheels. And as all the material was originally destined as scrap, a nice saving in cash resulted, too.

The two smaller wheels are now mounted on their framework (there are over 300 12 BA nuts on this item alone), and placed in position in the model brick headstock which has been built up course by course. The headstock is now completed, and I hope to describe its construction at a later date, when a photograph of it may be compared with a photo of the original structure.

To be continued.



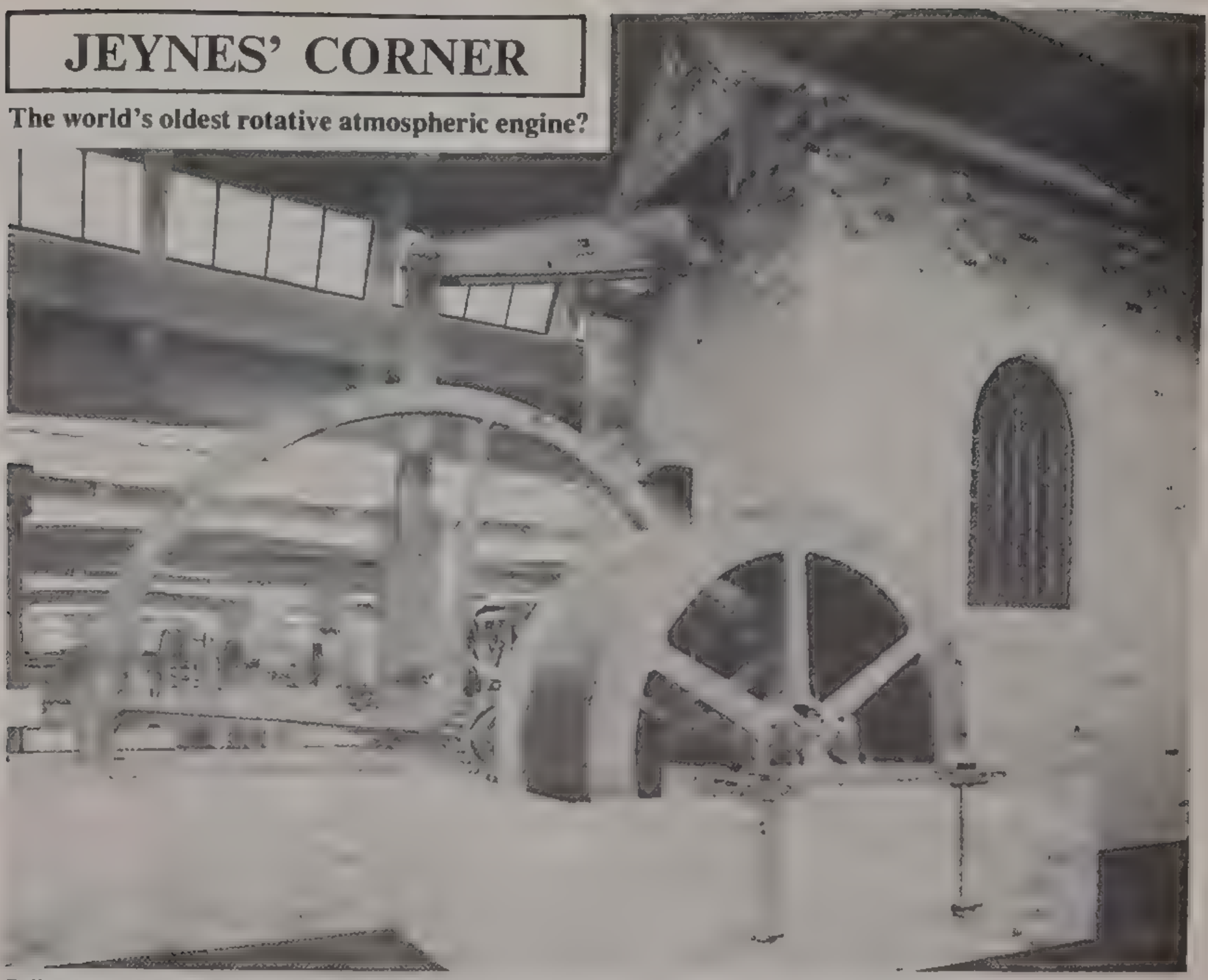
A view of the smaller pair of wheels mounted in the brickwork headstock.



A view of the four completed rope wheels with the two smaller wheels mounted in position. Since this photograph was taken the frame work has been altered to bring the diagonals under the top wheel bearings.

JEYNES' CORNER

The world's oldest rotative atmospheric engine?



Collections of Greenfield Village and the Henry Ford Museum.

MANY ATTEMPTS were made to convert the reciprocating motion of the Newcomen Engine into rotary motion, among which the experiments at Hartley Colliery in Northumberland in 1763 by Joseph Oxley are of note. It is recorded that James Watt visited the site after hearing what had been done there earlier. Another patent for rotative movement by a Newcomen engine was awarded to Matthew Wasbrough of Bristol. Later Wasbrough and Picard of Birmingham (who had patented the crank, thus stopping James Watt using it) fitted a flywheel, and they applied a dead weight to the crank end of the beam. Another attempt was by Francis Thompson in 1792; his engine had two cylinders placed one above the other, with a gland between them, and I believe the patent was made invalid, James Watt claiming that the second cylinder was a separate condenser, and infringed his patent. This engine had a crank and flywheel.

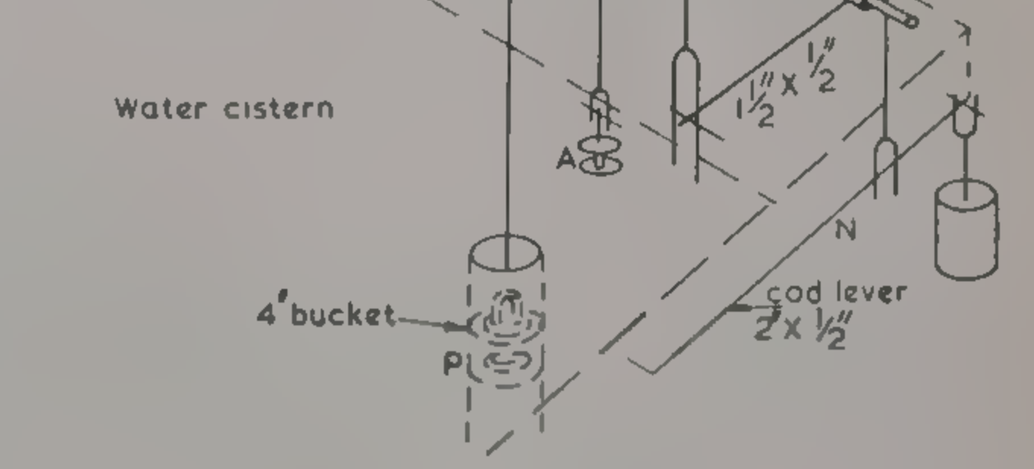
Somewhere around 1800, possibly earlier, there was a remarkable engine erected in the "Windmill End" area of Dudley. It was remarkable in several ways, as it worked for about 130 years as a colliery winding engine. It was purchased for preservation by the Greenfield Village and Henry Ford Museum at Dearborn, Michigan, U.S.A. It was also remarkable inasmuch as it embodied Newcomen's principle of atmospheric working, combined with Watt's separate condenser, and Richard Trevithick's idea of hinging the piston-cum-connecting rod in the piston, thus doing away with the need for parallel motion; further this engine was fitted with guide bars, between which a kind of crosshead worked: this had two steady rods between itself and the piston, and in the centre was an elongated opening for the connecting rod between the beam and piston to oscillate within.

The cast-iron beam was 16 feet in length, having a square hole cored in for the gudgeon pin which was also square, as was the crankshaft, and crank boss and eye holes. These were wedged and blocked in the good old fashioned millwright's manner. The bearings for the gudgeon pin and crankshaft were fitted with brasses only in the lower halves, the tops being cast-iron keeps. The connecting rod was 13 ft. 7 in. long, and was fitted

with a ponderous weight for the purpose of bringing the piston into a position where the vacuum caused by condensing steam under it could bring it down. The flywheel also had a square hole in the boss, and was wedged on the square shaft. It was 14 ft. in diameter with a rim 5 in. wide and 6½ in. deep: and having only four spokes.

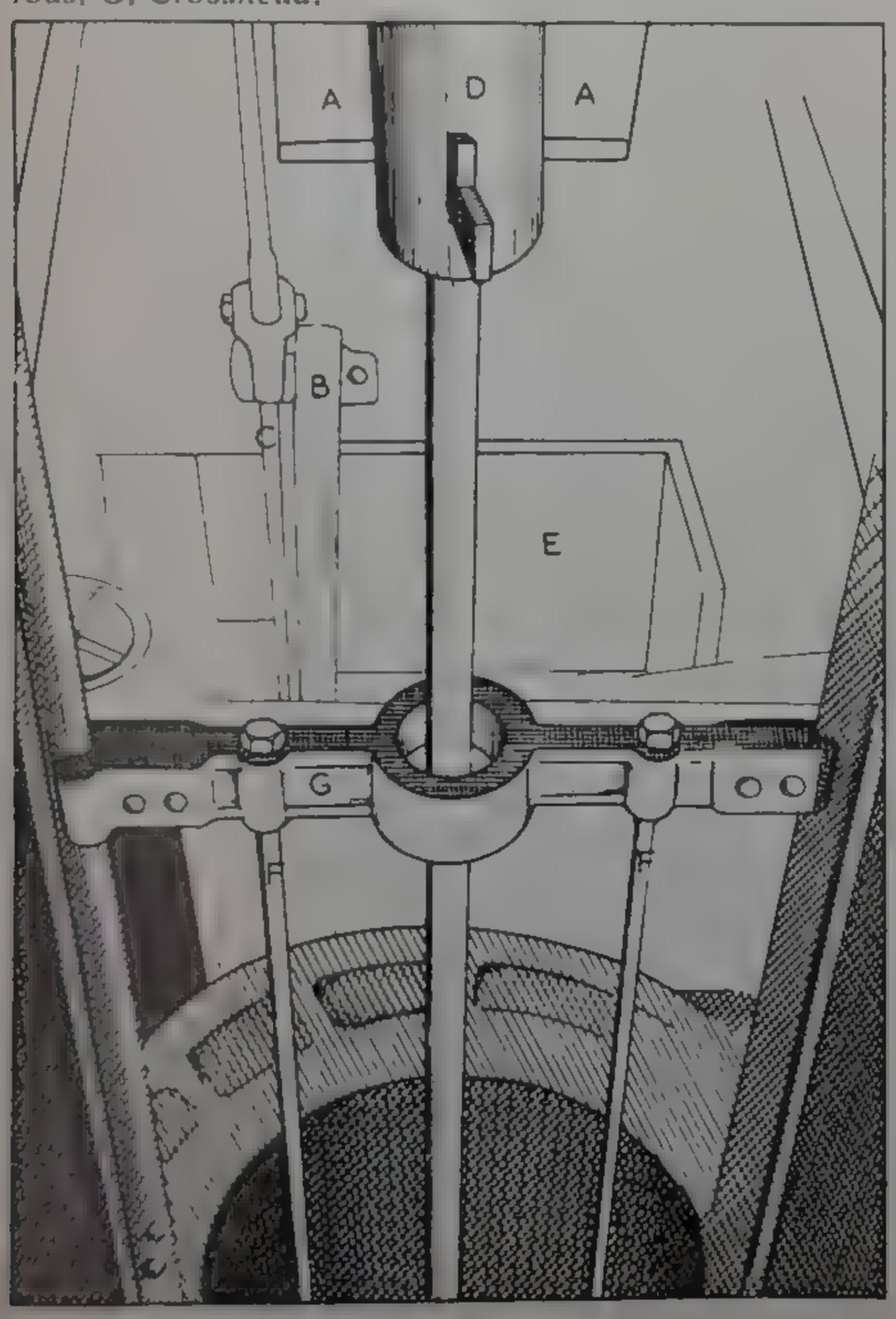
Originally the engine was supplied with steam only a few pounds above atmospheric pressure from a boiler of the type often called either a "Haystack" or a "Balloon" boiler; the latter term being the most accurate regarding its appearance, with the spherical top, insloping sides, mounted on brickwork, being fired somewhat in the manner of the old circular brick burning kilns. The pressure gauges on these boilers were just long hairpin-shaped glass tubes.

This engine was described in *Model Engineer* for 12/2/1931 by Mr. I. T. Astley, and in subsequent numbers the late George Gentry produced some detailed sketches of the valve gear. I disagree with Mr. Astley in his statement that the guide bars were fitted to "Spring Beams": spring beams were



Sketch by the late George Gentry (M.E. 12 Feb 1931).

Drawing based on Martin Anderssohn's sketch. A, Beam end; B, Support for plug rod vertical sliding bearing; C, Plug rod below knuckle joint; D, Gib and cottered bearing on head of piston/con. rod; E, Driver's seat; F, Steady rods; G, Crosshead.



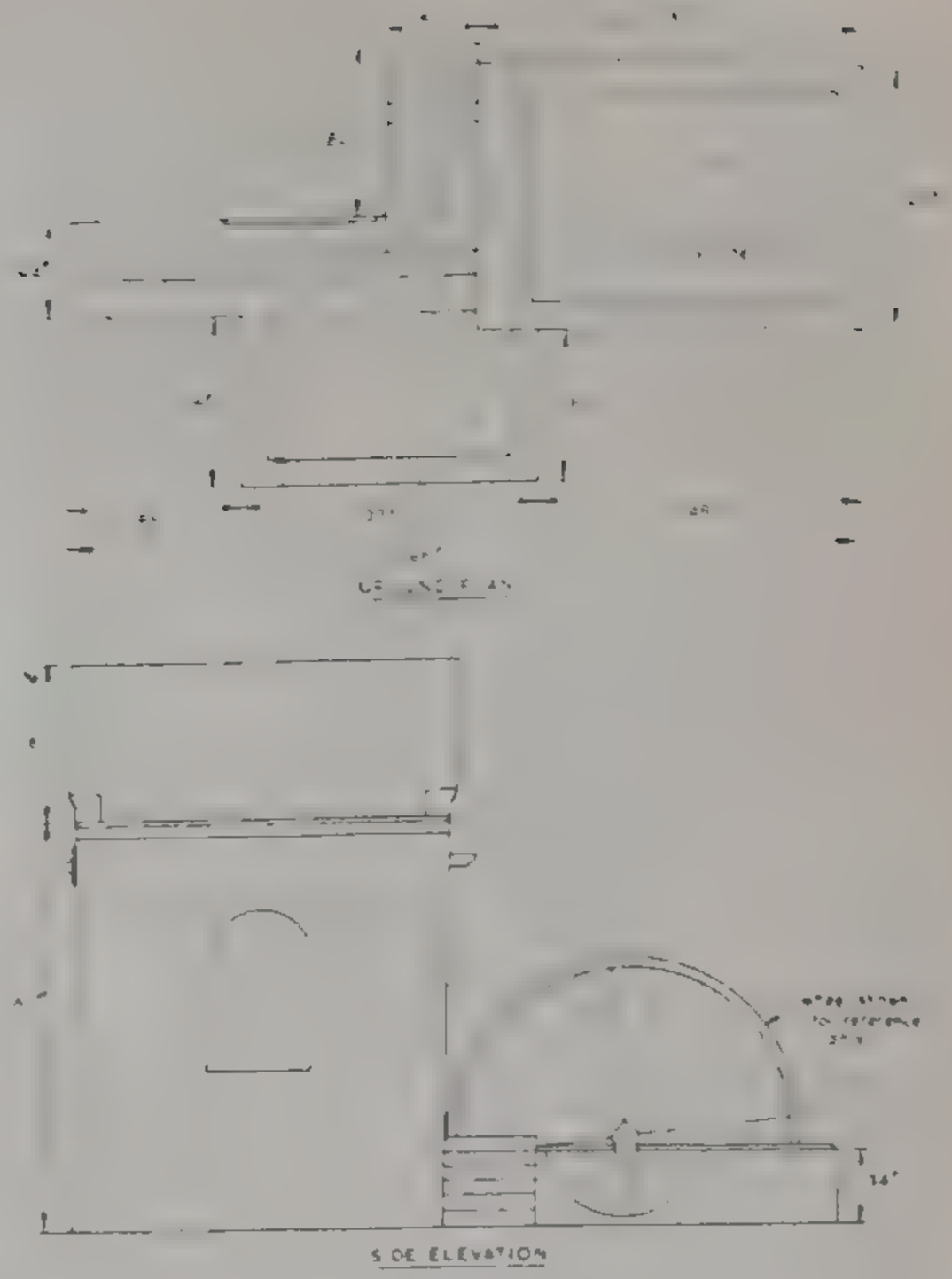
fitted to Newcomen engines to prevent the piston striking the bottom of the cylinder, and were fitted transversely under the beam; the supports for the guide bars would need to be rigid, certainly without any spring. In the case of this engine, the vibration of the beam was controlled by the crank.

Although a winding engine, it had no reversing gear, and great skill on the part of the engineman was required to bring the engine to rest with the crank in the position for starting in the required direction of rotation. Starting was accomplished by manual control of the valve, the crank having to be in a definite position in relation to the dead centre when the piston was near the top of its stroke. Before starting, the water seal on the top of the piston was made by putting several inches of water on top of it, and after making sure there was water in the supply for the condensing tank, steam was admitted to the cylinder, condenser, and pipework; closing the steam valve opened the water injection valve, and the water rushing into the condenser immediately caused a vacuum in the cylinder below the piston, and in the condenser and pipework, when the atmospheric pressure forced the piston down, thus raising the very heavy connecting rod, and as the crank passed its highest point, the injection water was cut off, and the steam valve opened

Reproduction of Mr. Astley's sketch of 50 years ago when the engine was working.

again thus destroying the vacuum, also driving the water and air out through the large flap valve at the bottom. The weight of the connecting rod again raising the piston ready for the next cycle when the tappets on the plug-rod could be brought into action, making the cycle automatic. The tappets were of angle shape, the top one being inverted to

Collections of Greenfield Village and Henry Ford Museum, Dearborn, Michigan.



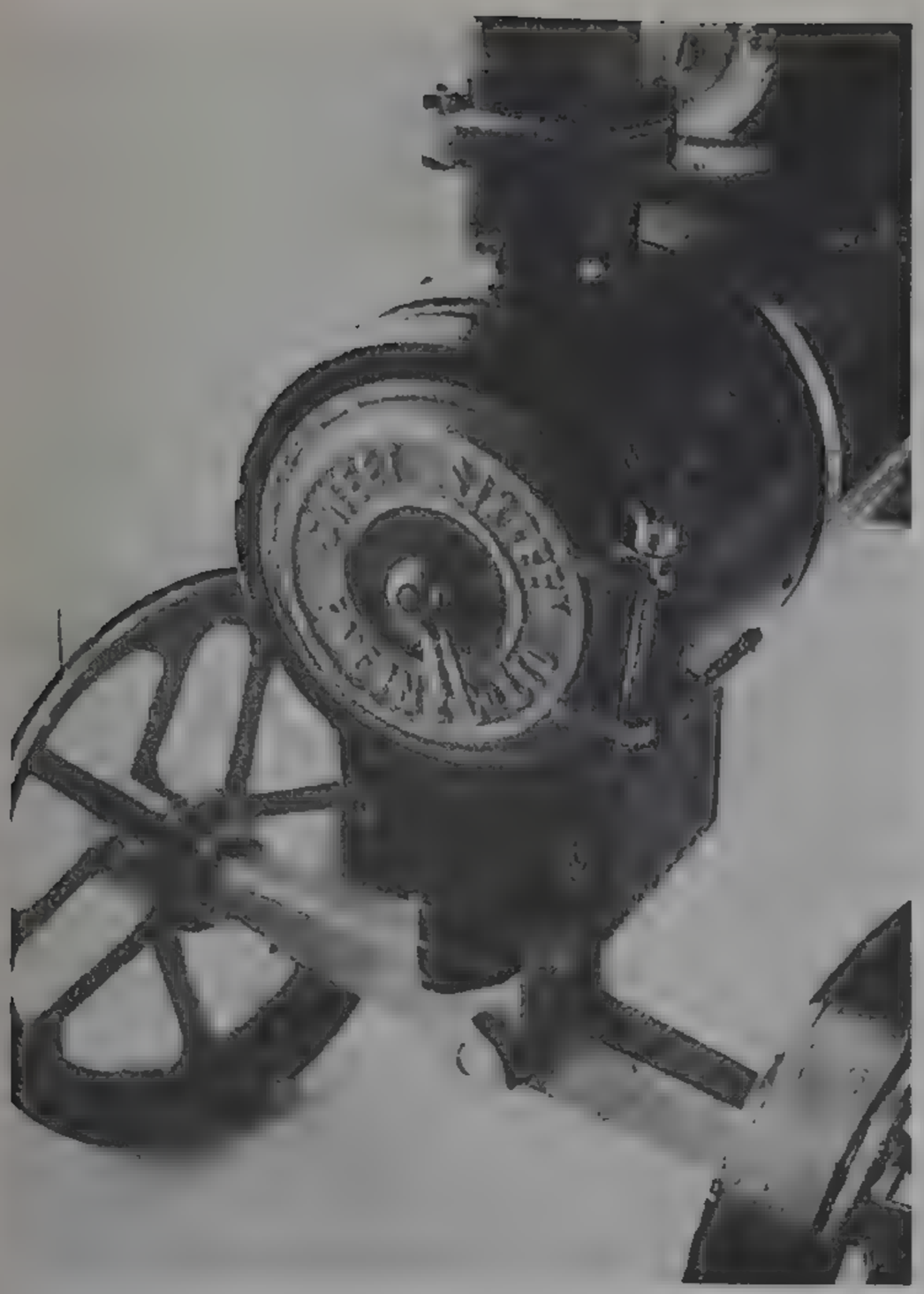
the bottom one. Their position was adjustable in a long shot in the plug rod, and they could be set individually. The top tappet had a spring and latch pin, and the bottom one had a roller on its pin: they could be thrown in, and out of action.

The water pump, which was 4 in. bore, had its bucket rod attached to the end of the plug rod, which had a knuckle joint in it near the top end, to allow the plug rod to work in a straight line in a bearer which was bolted to the top of the cylinder at one end, and secured to the wall supporting the trunnion bearings on the beam.

The spindle which worked the steam valve, and pump, and injection valve was carried right across the inside of the steam chest, the one end working in a blind hole, the other end made steam-tight by a cone working within a conical hole in the wall of the chest, the pressure on this being adjusted by a screw at the other end of the spindle.

The winding drum was 8 ft. 1 in. in diameter and was geared down from the engine by spur gears having a ratio of approximately 3.6 to 1. The driving gear being 20 in. in diameter, and the driven gear 72 in. diameter. Engine maximum speed 40 r.p.m.

The photographs are reproduced by courtesy of Greenfield Village and Henry Ford Museum, the sketches of the plan and elevation were produced for me by Mr. John Bowditch, who is Associate Curator of Power and Machinery at the Museum.



ETCHING SCALE NAMEPLATES

by R. L. Tingey

I WAS STRUCK recently by the number of models, beautifully detailed in all respects, but with no nameplate or numberplate. With modern techniques these are relatively easy to make and the process used is generally a photographic one, both for the production of embossed decoration and printed circuitry.

My electronic friends use a ferric chloride solution to make their printed circuit boards, but the copper on the board is only a couple of thou thick, at the most, and I found, on application, that a strong hot solution of this chemical took a very long time to etch away part of a copper strip. So I sought a more lively etchant, and from a rather obscure source came up with a copper oxidant etc, using ammonium persulphate and sodium chloride (common salt). So I experimented with this to find a formula which would work without attacking my resist.

The Resist

When metal is to be etched it is normal procedure to first clean and degrease the metal, wash it, and then apply a medium to the areas of the surface which are to be left in relief; this medium is called the resist. The old etchers used a black wax for this purpose, scraping away the parts to be etched. We want a simple way to produce first-class names and numbers, preferably without much skill; the modern way to do this is to use Letraset or other instant lettering. Our resist is to be Letraset, producing a good, professional looking plate.

When I experimented with the chemicals I used 16 gauge copper blanks with applied Letraset letters, A. B. C. etc. to identify results. The best results were obtained with the 25 per cent solution of ammonium persulphate saturated with sodium chloride at cold water temperature. When raised to its working temperature, in a water bath at about 45°C, the solution is no longer saturated and will etch at a rate of from .00025 in. to .00075 in. per minute dependent on material and temperature. The formula is rationalised to enable hot water mixing of the chemicals. The action of the bath is to oxidise the surface copper to soluble complexes of copper chloride and sulphate which turns the solution a green colour.

Preparation of the Blank

Nameplates made by this method can be of copper and copper alloys such as gunmetal, phosphor bronze and brass. The first requirement is a clean, smooth surface produced by first cutting out the blank and making it flat, by pressing in a vice, or hammering the edges on a flat surface with a covering slip of metal to avoid hammered marks. The blank is then rubbed down on medium emery cloth on a flat plate, followed by crocus paper with a final polish using Brasso.

Mark out the plate with a scriber or spring dividers, making the marks in the areas to be etched away. Immerse the blank in hot detergent and agi-

tate to remove all traces of the Brasso, wash and dry on a clean paper tissue. Treat the surface of the blank by immersing it in a bath of medium strength hydrochloric acid, to provide a conversion coating. The conversion coating improves the adhesion of the resist and to some extent reduces undercutting (etching under the edges of the resist). Wash the blank and it is ready to receive the resist.

Applying the Resist

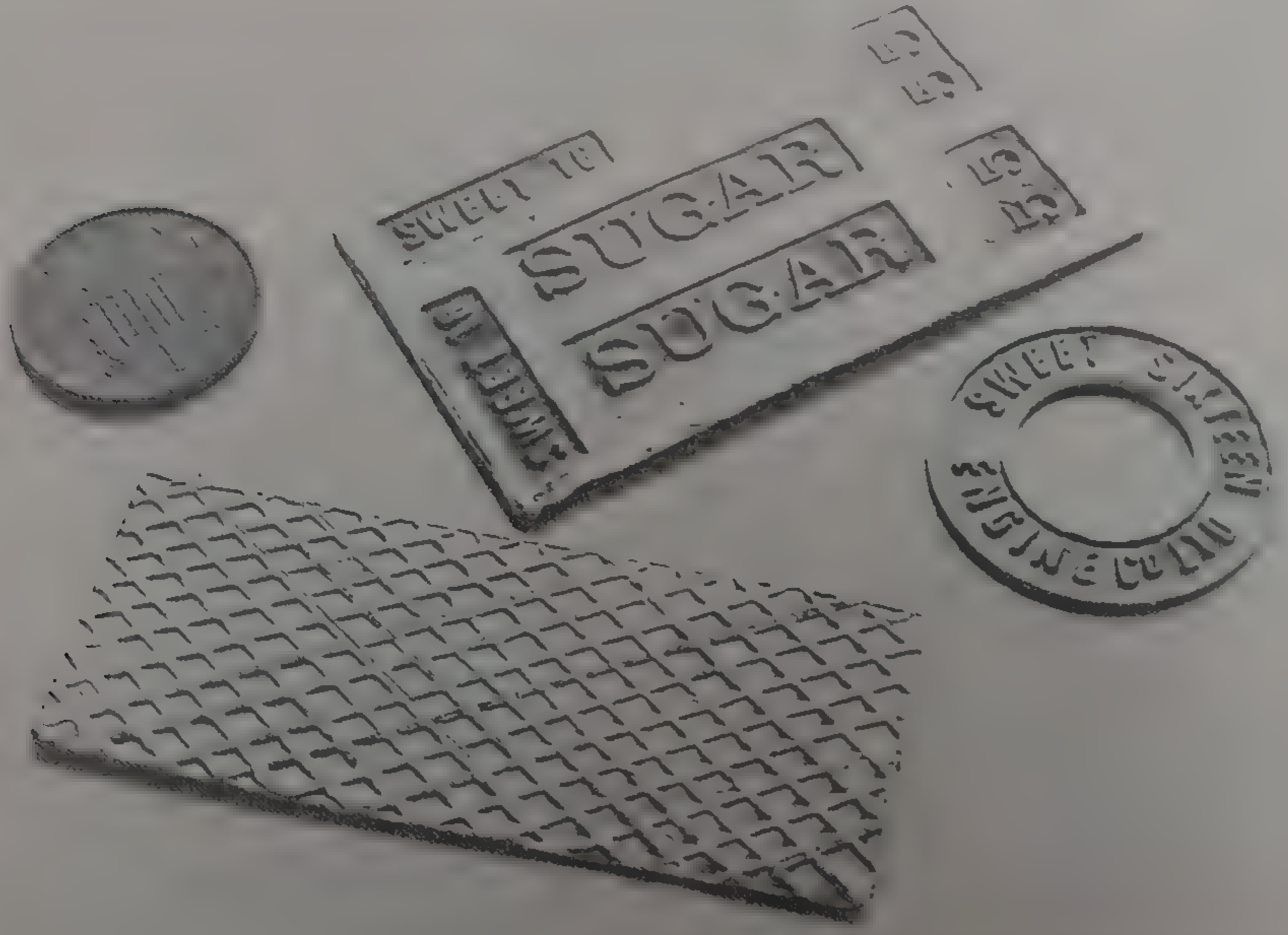
The lines originally marked out will still be visible to be used as a guide to applying the Letraset. Avoid, as far as possible, touching the cleaned surface of the blank with the fingers; fingerprinting does not seem to affect results adversely, but it is better to avoid problems. Letraset is applied, letter by letter, by selecting the required letter, placing and spacing it correctly, then rubbing the round end of a plastic ball point pen over the back of the sheet until the letter transfers cleanly onto the metal. The shiny side of the protective sheet is then placed down on the transferred letter and the back of this rubbed well with the same tool to ensure perfect adhesion. The protective sheet has a siliconed surface to assist the process.

When the name or full number is complete give a final rub down using the protective sheet before blocking out the other areas of the plate not to be etched, including the edges. For a blocking out medium nail varnish is used, diluted about one to one with acetone to be applied with a brush or ruling pen, like indian ink. Circles can be drawn with a compass fitted with pen; be careful not to overdilute the medium or it will spread. The ruling pen can give a line with an excellent edge if a little pressure is used to slightly score the metal at each limit of the line's width. The pen will need to be brushed through with the fluid after each line is drawn to keep the medium from drying in the pen. Buy a nail "polish" with a strong colour, such as blue, or dark red, so that it can be seen to be blocking out the work, with a thin skin, preferably.

Let the medium dry for 15 minutes before etching. Blobs of nail varnish may need much longer for complete setting or pock marks will appear etched in these areas.

To be concluded

Nameplates and footplating at various stages of finish.



TENTH INTERNATIONAL MODEL LOCOMOTIVE EFFICIENCY COMPETITION

FOR STEAM LOCOMOTIVES OF 3½ in. AND 5 in. GAUGES

TO BE HELD ON THE GUILDFORD MODEL ENGINEERING SOCIETY'S TRACK AT STOKE PARK, LONDON ROAD, GUILDFORD, SURREY

ON SUNDAY 9 JULY

commencing at 0900

ADMISSION 30p per person — Free Car Park

Refreshments available at the track all day

Mr. Martin Evans, formerly Editor of the Model Engineer, will present the prizes

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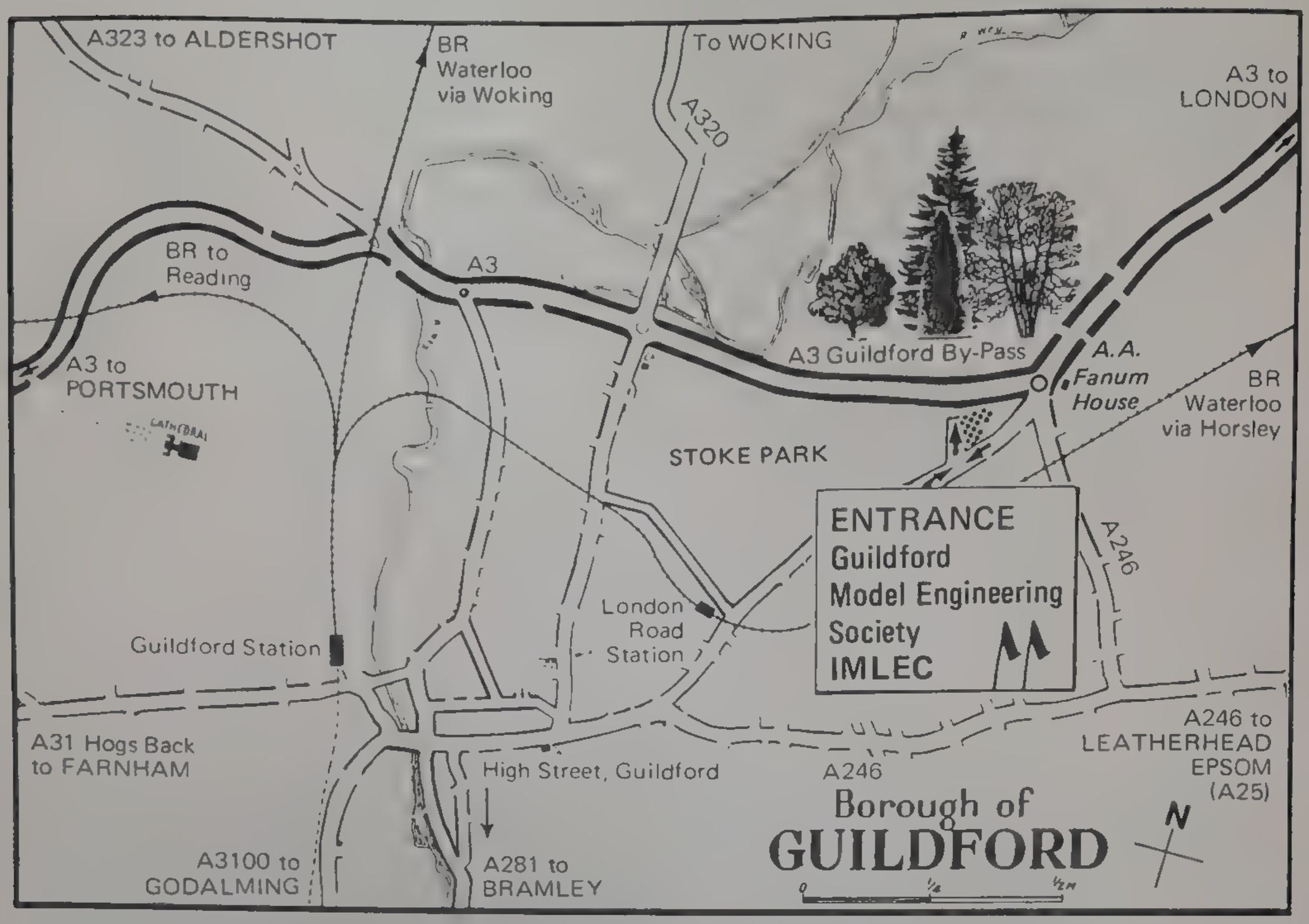
IMLEC COMPETITION RULES AND ORGANISATION

1. The Competition is open to 3½ in. and 5 in. gauge locomotives.
2. Entry is restricted to owners who have basically built the engine they enter (parts bought "outside", such as pressure gauges, boiler fittings, lubricators etc. will not disqualify). Overseas competitors may, however, enter any suitable locomotive.
3. No competitor may enter more than one locomotive.
4. No competitor may enter the same locomotive more than twice.
5. There will be 15 entries accepted on a "first come first served" basis.
6. An owner may nominate a driver if unable to drive the locomotive himself, but any prize won would go to the owner, not the driver.
7. Locomotives entered must carry a current boiler test certificate issued by a recognised society, or in accordance with the recommendations published in the "Model Engineer". This (or a photocopy) should be sent to the Secretary of the Guildford Society before the event.
8. Two sizes of anthracite coal will be provided by host society in weighed 2 lb. bags.
9. As much charcoal, paraffin, meths or wood as requested by the competitor will be provided for raising steam. Once a pressure of 60 p.s.i. has been reached the driver may, whilst waiting to go on to the track, start using the weighed coal provided for the competition.
10. The train with Dynamometer car will be prepared for the competitor who may choose the size of his load. Should the load prove too much for the loco, one or more passengers may be off-loaded at any time providing that the boiler pressure is not less than 60 p.s.i. when this is done.
11. The duration of the run shall be not less than 30 minutes, starting at the station. The timekeepers will keep competitors informed of their progress and will indicate when on the last lap. The run must finish at the station. Should a loco stop due to shortage of steam before reaching the station, even though it has been running for the full 30 minutes, the driver must "blow up" and complete the run to the station.
12. Water will be handed to competitors, as required, in suitable polythene containers so that they may "top up" without stopping.
13. No time allowance will be made for stops except in case of derailments.
14. At the end of the run, the loco will return to the steaming bay when all unused coal will be collected and weighed in the presence of the driver. No allowance will be made for unburnt coal left in the firebox.
15. The results will be calculated by the Society's officials and displayed on the notice board as soon as possible after the run.
16. The Society's speed limits must be observed. The official observer will warn drivers if speed limits are exceeded. Two warnings will be given but if a third is necessary, the driver may be disqualified.

17. Drivers must not lean on their locomotives to gain adhesion, neither must they apply the brakes to give added drawbar pull. They may brake to reduce *excessive* speed or in an emergency. Disqualification may follow disregard of this rule as in 16 above.
18. Sanding the rails will be permitted at the start only, at the discretion of the officials. Drivers of locomotives fitted with working sanding gear are at liberty to use it at any time.
19. The host Society will appoint a Panel of Judges whose decisions on all matters appertaining to the competition will be final.



Spectator tickets for I.M.L.E.C. are available from Model Engineer's offices, price 30p

CLUB DIARY

Dates should be sent at least five weeks before the event to ensure publication. Please state venue and time. While every care is taken, we cannot accept responsibility for errors.

JUNE

4 **Cannock Chase M.E.S. Steam up. Cannock Park 2 p.m.**

4 **Midland Counties Miniature Steam Engine Club. Austin 7 Club at Woolaton Park, to raise money for the Cheshire homes. All day.**

4 **Tyneside S.M.E.E.** Workshop, equipment and methods. Talk/discussion at Montague Baths at 7.30 p.m.

4 **Rugby M.E.S.** Members running day.

4 **North London S.M.E.** Marine Section Regatta. Victoria Park. 10 a.m.

4 **Harrow & Wembley S.M.E.** Marine pondside meeting. Public running.

4 **Birmingham S.M.E.** Visit from Greyfriars Social Arts & Crafts Club.

4 **Guildford M.E.S.** Running day for members at H.Q., Stoke Park.

4 **Bristol Society of M.E.E.** Public running at Ashton Court track. 11 a.m. to 6 p.m.

4 **King's Lynn & District S.M.E.** Boat meeting. B.I.S. Lake, Leziate.

4 **Stockport & District S.M.E.** Exhibition at the Armoury, Greek Street, Stockport, in aid of Pat Seed Appeal.

5 **City of Leeds S.M.E.E.** An evening with Mr. Beale.

5 **Leicester S.M.E.** Making a 3" ploughing engine by Mr. Munday. The Royce Institute, Crane Street, Leicester. 7.30 p.m.

5 **Worthing & District S.M.E.** The Brighton Museum of Transport — talk by B. Hewings. Broadwater Parish Room. 7.30 p.m.

6 **N.W. Leics. M.E.S.** Visit to Cadeby light railway. Depart Snibston Miners Welfare Centre, Coalville at 7 p.m.

6 **S. Cheshire M.E.S.** Model traction engines. J. Riley and D. Lawton. Victoria Hotel, Crewe, 7.45 p.m.

6 **Taunton M.E.S.** Practical wiring of electric motors for model use by Mr. Snazell. Taunton Rugby Comm. Rooms. 7.30 p.m.

7 **Cannock Chase M.E.S.** Meeting Cannock Park. 7.30 p.m.

7 **Stockport & District S.M.E.** "Bits and Pieces." The Parish Hall, Cheadle Hulme. 8 p.m.

7 **Harrow & Wembley S.M.E.** Committee.

7 **Portsmouth M.E.S.** General meeting. Y.M.C.A. 7.30.

8 **Leyland, Preston & District S.M.E.** Meeting at Roebuck Hotel, Leyland. 8 p.m.

9 **Rochdale S.M.E.E.** Springfield Park. "Bits and Pieces."

9 **Polegate & District M.E. Club.** Windmills talk by Barry Funnell.

10 **Gauge "1" Model Railway Association.** Get together.

10 **King's Lynn & District S.M.E.** Boat meeting. B.I.S. Lake, Leziate.

10 **Sussex Miniature Locomotive Society.** S.M.E.E. and Eltham S.M.E. visit Beech Hurst.

Continued on page 658

Club Chat . . . with the Editor

Mid Cheshire S.M.E., after two years of hard slog, have completed and opened 500 ft. of 3½/5 in. track at ground level on a concrete base. It has a turntable and points and, of course, steaming bays. Both ends have water towers and the steaming bay end has coal bunkers. The track, which opened on 20 May, should be in operation most Sundays in summer when it is hoped that the present small membership will grow. The secretary is Mr. B. Storey, and you can find him at 10 Derwent Avenue, Winsford, Cheshire. Telephone number is Winsford 4789.

Also up that way on 10/11 June, the **Northern Association of Model Engineers** are holding their own locomotive and driving trials. This year the event is being organised by **Urmston and District M.E.S. Ltd.** at their track in Abbotsfield Park, Chassen Road, Flixton, Manchester. There should be ten locos running on each day. N.A.M.E. emphasise the fact that this is not an efficiency competition but a test of loco and driver and the person who enters need not necessarily have built the loco. There are trophies for 3½ in. and 5 in. winners and an additional trophy will be awarded to the best turned out loco running. It is possible that by the time this issue is out, the entry list will be full, but if you wish to know more or just require spectator tickets, contact the Urmston club at Abbotsfield Park, Chassen Road, Flixton, Urmston, Manchester.

This year **Erith Model Railway Society** are co-operating with Plumstead Make Merry Committee of the Greenwich Festival in organising what will be their 5th annual exhibition which will be in the Sports Hall of Plumstead Manor School, Old Mill Road, Plumstead Common, on 17/18 June. The exhibition starts at 10.30 a.m. on both days and finishes at 9 p.m. on Saturday and 6 p.m. on Sunday. Live steam from the Gauge "1" Association and a 40 ft. layout from the Tramway Society will join the Erith club's own tracks, and **Welling & District M.E.S.** will operate a passenger-carrying service. For more details contact D. J. Murrells, 428 Bedonwell Road, SE2 0SE, tel. 01-310 6773 or Erith 36533 ext. 129 during office hours.

For scale ship enthusiasts, the **Paddle Steamer Preservation Society** is holding its annual Models Rally for scale ships, paddle and screw, and rigged sailing ships on the Prince of Wales Pond, Blackheath, SE3, at 14.00 hrs. on 10 June. Presented here will be the Allan Waller Memorial Trophy for scale paddle steamers and these and screw-propelled models are welcome. Secretary is A. J. W. Rickner of 16 Blunts Road, Eltham, SE9 (01-859 1757).

I am told that at **Chichester & District S.M.E.** there has been hectic activity over the past few months as members prepare for the biennial Steam Days — 24/25 June and 1/2 July. The public are only admitted on these days so for the residents of that area it should be an event to look forward to. This year there is a new 10¼ in. track, 900 ft. long, and the loco for this is now 69 years old — complete with new boiler. She was built in 1909 by Mr. R. A. Briggs who may be remembered for his Briggs Automatic Panic Bolt of 1892 — still in use on fire doors in theatres, etc. The loco was named *Winnie* and her new track will be opened by a grandson of Mr. Briggs. Supporting this event will be a 3½/5 in. raised track operation, demonstrations of machine tools and models, and a gauge "1" layout. The track is at the back of Bognor Road, Chichester, and can be entered through Adcock's Garage for the sum of 15p. Times of opening are 11 a.m.-7 p.m.

Moving now to the effects of AGMs we find that at **West Wilts S.M.E.** on 4 April, the Hon. Sec. became Tom Buckland who can be found at 39 Hollis Way, Southwick, Trowbridge, Wilts. Other officers elected were Tony Daw (Chairman) and Des Clarke (Hon. Treasurer). From May to August there is usually activity at the club's track at Queen's Road, Westbury, Wilts., every Sunday morning. We are also told that there are meetings at 7.30 p.m. but, regretfully, not which days although it is possible that we have already mentioned this in a previous issue.

There has also been an AGM at **West Riding Small Locomotive Society** at which a presentation was made to Albert Woodhead in appreciation of his efforts on behalf of the Society. The Hon. Sec. here is Tony Roberts of 76 Amersall Road, Doncaster DN5 9PH. This issue comes out just at the right time to remind anyone in that area that West Riding's 1978 Rally takes place on 3/4 June and reading through Gordon Bullard's list of models which have come to light since the winter, there should be an interesting line-up. Gordon, by the way, is the new treasurer at the Society. On 29 March the club had a diesel night and the performance of the locos appears to have impressed more than one steam man. As the run was at night, the success of the venture was emphasised by the signalling system which has been the work mainly of Dereck Fowler, Sid Bennett, and The "Toff" Beaumont. Make a note of West Riding's efficiency trials — 22 July.

At **Hull S.M.E.** where the AGM was held in March, all the officers were re-elected except the treasurer. In that post the new boy is David Leeson. This club also held a competition for the "Shep" Trophy which was won by John Speak with a 3½ in. "Royal Sovereign" at his first attempt. The secretary, Mr. J. M. Proud of No. 1 Sixth Avenue, Ellerburn Avenue, Hull (tel. 856701), tells us that all boilers, including those of visitors, must now have a current certificate before running on the track can be considered.

Birmingham S.M.E. Ltd. held their AGM on 15 March and the following officers were elected: President, Mr. M. J. Salisbury; Vice-President, Mr. R. Peach: Hon. Sec., Mr. G. F. Sherbourne (91 Kitchener Road, Selly Park, Birmingham B29 7QE); Hon. Social Sec., Mr. P. D. Lakin; Hon. Treasurer, Mr. E. Richardson; Hon. Editor of News, Mr. L. Beech; Hon. Librarian, Mr. P. Wardle: and Public Relations Officer, Mrs. M. P. Mason.

More new faces at **Chesterfield and District M.E.S.** where on 21 May Mr. John Sharman became Chairman and Mr. Terry Rose Vice-Chairman. Mr. Brian Watson (209 Hemsworth Road, Norton, Sheffield S8 8LP) took over the Hon. Sec's job from Alan Rutherford. At this meeting, too, an award was made for the most innovative/interesting item. Known as the E. W. Hall Trophy, the prize went to Mr. G. Robinson for a clock mechanism. As Mr. Robinson is a new member it must have come as a most welcome introduction. Like many clubs, Chesterfield are finding a wide range of model engineering interests among their members. Alan Rutherford tells us that over this winter many members have been pooling their resources in the construction of a 7¼ in. gauge loco, cars, and ground level track. Based on the Romulus N.G. design, the loco is now complete and steaming, which deserves every congratulation for a fine effort as she was started last September. The AGM discussed a suitable name and came up with *Percy*, after the late Mr. Percy Pearson, a founder member of the Society and latterly vice-president. The 7¼ in. track is laid at

Papplewick Pumping Station which I mentioned a few issues back and will operate on each of the station's steaming days to the end of the season.

The venue for **Kendal Model Live Steamers'** AGM on 9 March was the Black Swan Inn which is also where the club meets each second Thursday in the month. Despite the rather low club membership there appears to be plenty of interests and last year saw a trip on Lake Windermere in a steam launch, a model traction engine steam-up, "O" gauge steam loco running, and power and steam consumption tests on stationary engines. This year the activities will be similar with the addition of portable track construction. The secretary here is Mr. J. M. Richardson of 142 Windermere Road, Kendal, Cumbria.

The MPD Secretary for **Bracknell Model Railway Society** is now Mr. G. L. White, c/o Pine Halt, 28 Longdown Road, Little Sandhurst, Nr. Camberley, Surrey, and up in **Stockport and District S.M.E.** where the AGM was held on 7 April, the new secretary is Mr. R. G. Colbran of 2 North Park Road, Bramhall, Stockport, Cheshire, SK7 3JR. The meetings here are held on the first and third Fridays in each month at the Parish Hall, Church Road, Cheadle Hulme, at 8 p.m. Loco builders will wish to know that the club has over 1000 ft. of raised 2½/3½/5 in. track now in operation after winter overhaul. They are also building a ground level 7¼ in. track and the first 100 ft. was opened on Good Friday by Mr. Kay's loco. On 4 June this flourishing club is staging a display of models in The Armoury, Greek Street, Stockport, in aid of cancer research.

At **Harrow & Wembley S.M.E.** the AGM announced the go-ahead to start work on a raised track but the call is for volunteers to build it. It has been agreed that the best way of going about it would be on a long-term basis so that finance and assistance can be arranged in good time. They are also considering an extra rail for gauge "1". This club is arranging for an exhibition to be held on 30 September but we will carry more details later. Hon. Sec. here is Peter Reed, 5 Rydal Gardens, Kingsbury, NW9 (01-205 9031). By the way, I notice that *The Con-Rod*, journal of Harrow club, gives 8 July as the IMLEC date. This, of course, should be 9 July.

The AGM of **Peterborough S.M.E.** elected Mr. S. Bates as secretary. Mr. Bates lives at 15 Briar Way, Peterborough, PE1 5LH (tel. 69187). He tells us that there may be some readers unaware that the Nene Valley Railway is very close to their track at Peterborough and visitors to the club or Nene Valley may like to "do the double".

Way down in Sussex at Beech Hurst, the AGM did some shaking of names in the hat but Chris Saunders remains Hon. Sec. His assistant, Allan Killick, has agreed to act as News Co-ordinator so that the Editor of *S.M.L.S. News*, Alan Gettings, who, of course, has moved to Axminster, can be kept up-to-date and the *News* will be published regularly. **Sussex Miniature Locomotive Society** have had a slight problem with electrical conductivity in the sleepers which plays mayhem with the signalling system. Although the fault has tended to rectify itself, I expect it was that which made me cross a red last year (?). The **S.M.E.E. and Eltham S.M.E.** are visiting Beech Hurst on 10 June and the Autumn Rally is fixed for 7/8 October.

Way down further at **The Steam Locomotive Society** of Victoria they think that last year was a quiet one with not much being done although they did upgrade their 2½ in. track. But it looks as though there is plenty of work in the offing and bearing in mind that the winter is starting down there we should hear of some progress in a few months. The secretary is Mr. K. Tinkler, P.O. Box 115, Moorabbin, 3189 (tel. 95 1171).

The **Australian Association of Live Steamers** have just sent me a copy of a new publication launched in February by Diamond Valley Railway Ltd. It is called *Directory of Australasian Railway and Tramway Societies 1978* and must be a boon to residents or visitors interested in the preservation of railways or the operation of miniatures. It costs $2.50 plus p. & p. from D.A.R.T.S., c/o 5 Highgate Grove, Ashburton, Victoria 3147. We have often been asked here for addresses of clubs by people who are visiting that area and this book covers Australia, Tasmania, New Zealand, and that just about exhausts my geographical knowledge. Kenith T. Tinkler, the Hon. Sec. of Australian Association of Live Steamers and the Steam Locomotive Society of Victoria, sends all *M.E.* readers greetings from live steam enthusiasts in Australia, which, I am sure, are readily reciprocated. Mr. Tinkler lives at 8 Maralber Road, Highett, Victoria, 3190, Australia.

We welcome Jim Gregg to the editorial chair of *Cinders and Soot*, the journal of **Castledare Miniature Railway of W.A. (Inc.)**. The secretary is Mr. R. A. Barltrop of 26 Elizabeth Street, Osbourne Park, W.A. 6017 (tel. 49 6573). It appears that somehow a rumour has gone around that the 1979 Convention of Castledare may be cancelled and the President, Mr. R. L. Moss, is anxious to stress that the Convention is definitely on, at Perth.

Finally, I would just like to emphasise again that IMLEC is at Guildford on 9 July, starting at 9 a.m. and spectator tickets are now available from this office price 30p. The rules appear elsewhere in this issue and a booklet explaining what it's all about will be available from the Guildford Club. See you there.

CLUB DIARY *continued*

10 Milton Keynes M.S. Portable track, Bradwell Abbey field centre, Milton Keynes. 2 p.m.
10 Annual Models Rally for scale ships, paddle and screw and rigged sailing ships at the Prince of Wales Pond, Blackheath, SE3 2-5.30 p.m.
10 Guildford M.E.S. Visit by G.M.E.S. to Mote Park, Maidstone.
10 St. Albans & District M.E.S. Loco meeting City Hospital, St. Albans.
10 Gauge "O" Guild. Joint meeting between the Guild and W. Lancs Gauge "O" group at W.L. "O" group H.Q., Merseyside 2-6 p.m.
10 S.M.E.E. Day visit to S.M.L.S., Beech Hurst.
10-11 Northern Association of Model Engineers. Competition 10 a.m. to 6 p.m.
11 N. London S.M.E. Open day. Colney Heath.
11 Carlisle & District M.E.S. Track at Upperby Park, Carlisle 3½"-5" and 7¼" gauges.
11 Furness Model Railway Club. Carlisle live steam open day.
11 Harlington Locomotive Society. High Street, Harlington. Public open day 2-6 p.m.
11 Huddersfield S.M.E. H.S.M.E. members only competitions, Marbelhead & Whitwall trophy and free running.
11 Birmingham S.M.E. For the energetic, a sponsored canal towpath walk from Lapworth to Solihull Lodge. Proceeds from B.S.M.E. members and friends will be split 50% with B.S.M.E. and the Canal Society.
11 Bracknell Railway Society. Public running.
12 Wirral M.E.S. Talk and discussion, "Workshop practice for beginners". J. N. Rudd.
12 King's Lynn & District S.M.E. Monthly meeting. St. James School, London Road, King's Lynn 7.45 p.m.
13 Milton Keynes Model Society. M.S. boating evening, Willen Lake, Milton Keynes. 7 p.m.
13 Sutton Coldfield & N. Birmingham M.E.S. Talk by Mr. S. Jones, "Metrication". Wylde Green Library 8 p.m.
13 Stafford & District M.E.S. Track night, County Showground, Stafford 7.30 p.m.
13 Guildford M.E.S. Executive Committee meeting.
14 Harrow & Wembley S.M.E. Track meeting. Roxbourne Park track 7 p.m.
14 Southampton & District S.M.E. Chairman's Evening and Southampton Show arrangements. Malvern Hotel. 8 p.m.
14 Birmingham S.M.E. Visit from Wheelers Lane. Railway enthusiasts.
14 Bristol S.M.E.E. Films of western region Shap and Beattock by Mr. Lanford, at the British Rail Staff Association Club, The Incline, Temple Meads Station. 7.30 p.m.
15 Perranporth & District M.E.S. Talk, "Canadian Railways". Perranzabuloe Church Hall. 7.30 p.m.
15 The Nottingham Society of M.E.E. Valley Road, 1st Grand Track night.
15 Hull S.M.E. Building of the "Tirpitz" — Charles Smith.
16 Brighton & Hove Society. A.G.M. Elm Grove School, Elm Grove, Brighton. 8 p.m.
16 Fairbourne Railway Ltd. Railway films. Presented by Hugh Sykes. The National Children's Home, Princess Alice Drive, Sutton Coldfield, Midlands. 7.30 p.m.
16 Furness Model Railway Club. A.G.M.
16 Stockport & District S.M.E. Talk. The Parish Hall, Cheadle Hulme. 8 p.m.
16 Romford Model Engineering Club. Track night.

Post Bag

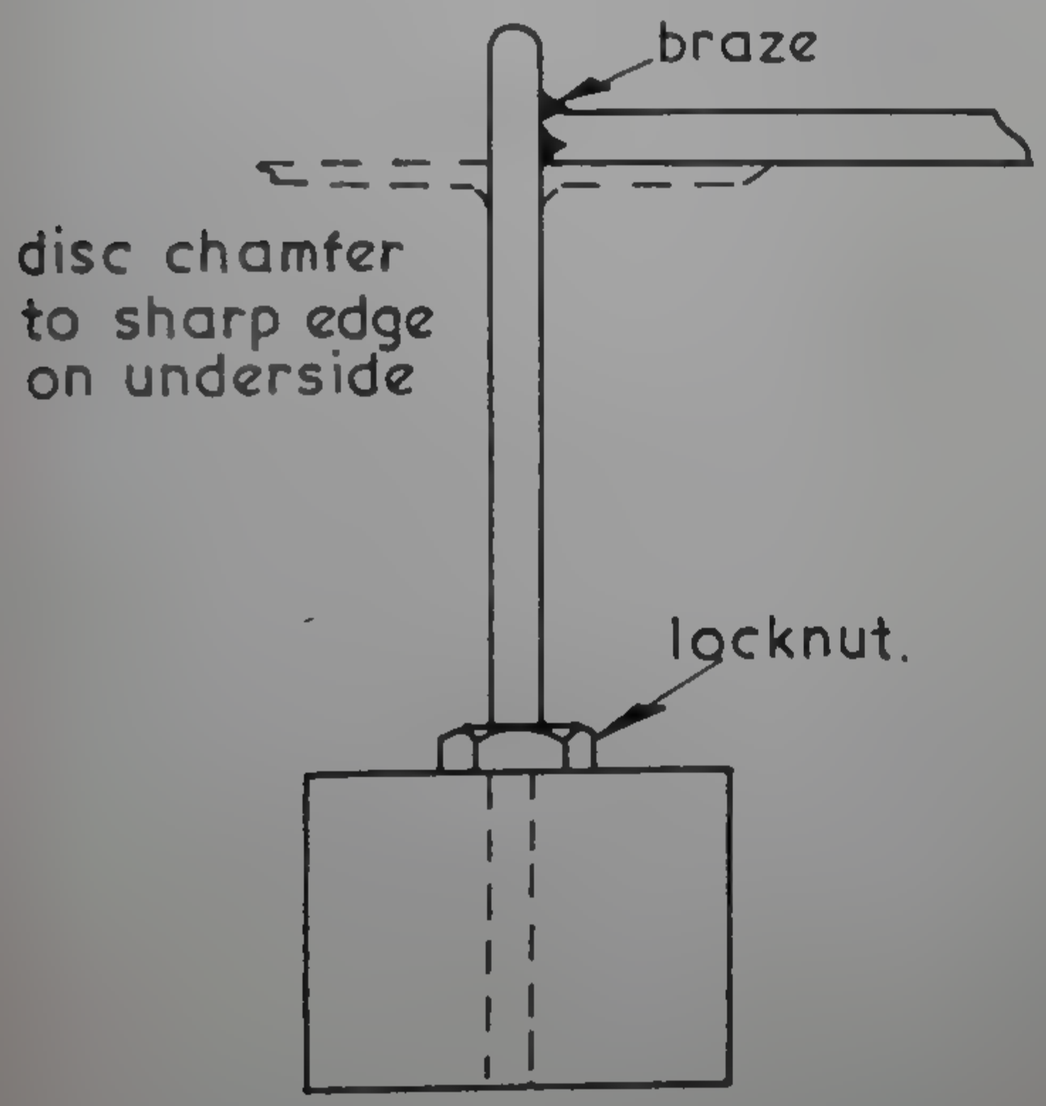
The Editor welcomes letters for these columns. Pictures, especially of models, are also welcomed. Letters may be condensed or edited.

Centre Height Finder

SIR,—The centre-height finder in December issue although interesting has a great drawback as it cannot be used for boring tools. It also involves winding the saddle back and forth each time. The simple item I have used for the last 30 years, made from scrap, easily and quickly works with all tools in any position. The sketch shows a small base, any height to suit the lathe (about 1 in. by 1½ in. is ample), and can be round, hex. or square; the only proviso is that it must be faced flat with a hole drilled at the same time square to the face and tapped any convenient thread.

A stem is then screwed and fitted with a lock nut after first brazing the arm on. If no brazing equipment is handy, the stem could be slotted and a piece of hacksaw blade with the teeth ground off fitted in. This could be clamped with a screw at the top of the slot or soldered in place. Screw in the base, set to height, and lock with the nut. This can be made for use either on the bed or top of the saddle as the user prefers. A thin disc can be fitted tight under the arm if required for parting-off tools ,shown by dotted lines), but a little more care is required to get both disc and arm on centre. As they are so simple and quick to make some users may wish to make one of each to save time. I keep these on a shelf above each machine and the time saved in setting tools is amazing, quicker than it took to wind the saddle up and down the bed which also causes more wear to the saddle.

Lincoln. C. A. Foyster



CENTRE HEIGHT FINDER

LBSC's "Ten-footer"

SIR.—In his excellent report on the LBSC Memorial Rally and Exhibition, organised by the North London S.M.E., which I had the privilege to attend, Mr. D. E. Lawrence is a little "way out" when he states that *Rola* is loosely based on a Bristol and Exeter Pearson single, the largest of which never had wheels more than nine feet in diameter.

Curly mentioned this engine several times to me during its building and wrote, on 17 January 1962: " . . . If you look up Vol. 6 of the *Loco Mag*, you'll see the ten-footer I copied on page 45. The only thing is, that the original was broad gauge but I made mine standard gauge, so she could run on my 32 in. line. This meant bringing the cranks closer together and raising the boiler a little to clear them. Otherwise she is as the picture. I used solid centre castings for the wheels and gave her a period 6-wheel tender with a sloped, flared coping. When the footplate, with the railings, was standing on the bench before fitting, it looked exactly like a doll's cot.

"I call her *Rola*, because she looks like one, and on the road she is a scream. The way the tiny boiler steams the big cylinders (equal to 17½ in. x 28 in.) is just nobody's business. If you read my introduction in *Practical Mechanics* last February, you'll see what she did on her trial run . . . " Mr. Christopher Pearson now owns *Rola* and she still runs extremely well as I know from first hand, having driven her quite recently. The drawing mentioned by Curly, published in the *Locomotive Magazine*, was by E. F. Bird, who made the first serious attempt at writing the history of the broad gauge locomotives of the Great Western Railway, and this was published in the *Locomotive*, Vols. 6-8 (1901-3). Bird's line drawings, the early ones derived from the sketches and drawings made by E. T. Lane at Swindon in 1848-9, were afterwards published as a wall chart by the Locomotive Publishing Company. They are the only known illustrations of many of the early engines and, half a century later, when the Railway Correspondence and Travel Society published its splendid history of the broad gauge locomotives (still in print), some of Bird's drawings were used again.

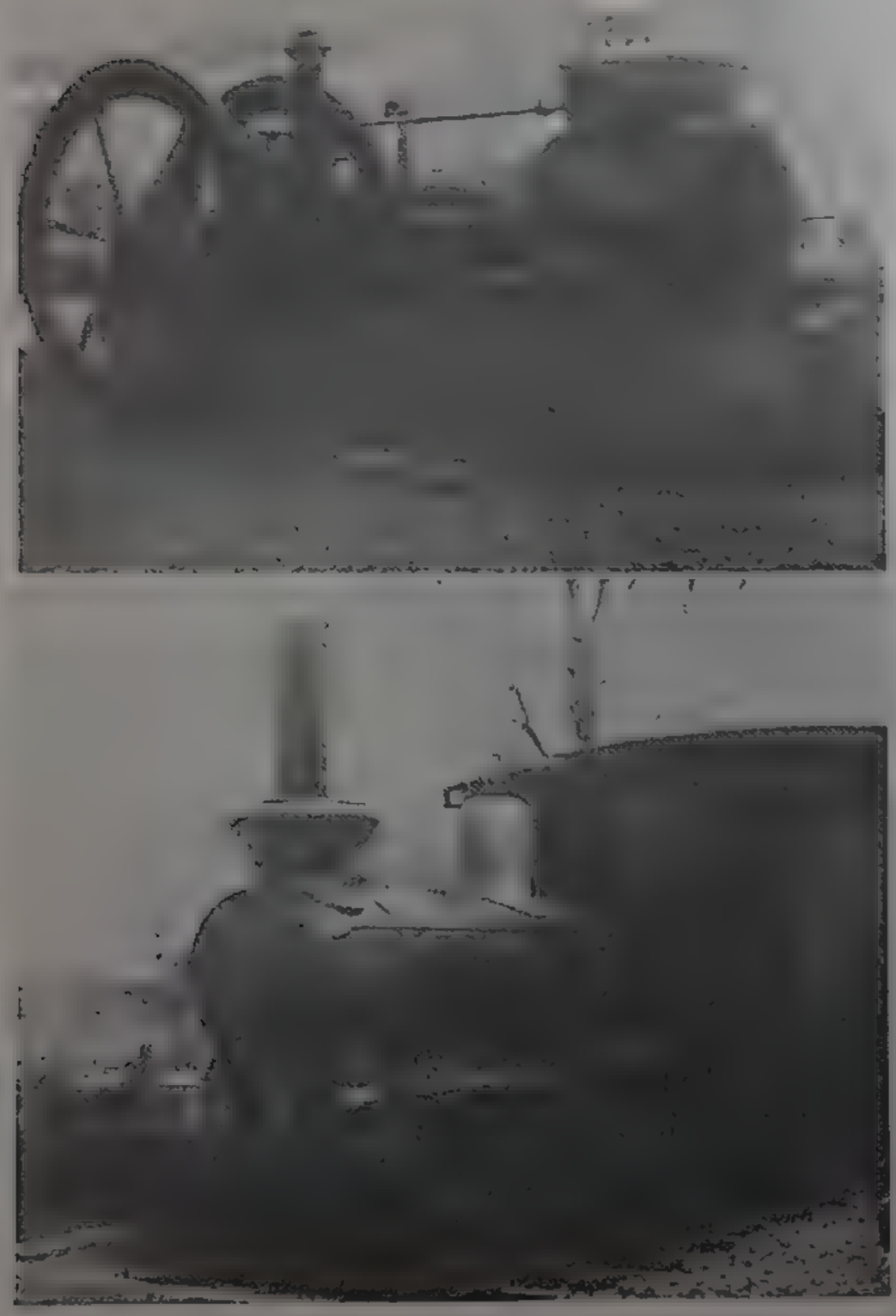
Rola's prototype was *Ajax*, a 2-2-2 delivered by the makers, Mather, Dixon & Co. of Liverpool, in December 1838. By June 1840 *Ajax* was out of use and was later used as a stationary engine. Originally, she had ten-foot driving wheels, built up of boiler plates, with five-foot single plate carrying wheels and 14 in. by 20 in. cylinders. It is an interesting fact, recounted by Bird, that in 1846 the G.W.R. lent four ten-foot wheels to Messrs. Grissell and Peto to transport the equestrian statue of the Duke of Wellington from the sculptor's studio in Harrow Road to Hyde Park. These wheels are believed to have been from *Ajax* and *Hurricane*, another early ten-footer, built by R. & W. Hawthorn. Solely in the interests of accuracy, I must point out that *Tugboat Annie*, Curly's eight-beat "Pacific" has Baker valve gear, of course. I was very interested to read Mr. J. B. Rowley's letter on variable blastpipes in *M.E.* 3576, with his references from the works of Colburn and Ahrons. Since writing my letter on this subject (*M.E.* 3560) I have discovered in my copy of Ahrons' *The British Steam Locomotive* a drawing and short description of the 2-2-0 engine *Pioneer*, built in 1832 by Rothwell, Hick & Rothwell, of Bolton, for an American railway and this locomotive had a variable blast pipe, which had an inverted cone in the orifice and the amount of opening could be controlled by the driver. As Mr. Jeynes states that Hawthorns were using a variable blast pipe in 1829 the year of the construction of the *Rocket* — it would appear, as he remarks, that this device is nearly as old as the steam locomotive.

New Romney, Kent. George Barlow

Swedish Locos

SIR,—Alas, Sweden is not a country where there is any particular interest in historical machinery, neither full size nor models. Here are very few enthusiasts who build models of steam engines, locomotives and the like, and the number of preserved old steam locomotives in the country can be counted on the fingers. It is, therefore, notable when you find something that might perhaps interest the reader of *M.E.* Here in Malmo, I have however, found the steam engine pictured in the enclosed photographs. It is an interesting construction with the high pressure cylinder in one end of the fundament and the low pressure one in the other end. It was made by Braunschweigische Masdrinenbau-Austalt in Braunschweig. It has a stroke of 90 cm. (3 ft.). The high pressure cylinder has a diameter of 50 cm. (20 in.) and the low pressure one is 90 cm. (3 ft.) in diameter. The machine is placed as an eye-catcher outside our little technical museum. On a short piece of rail there are also two old and very small locomotives which were up to about 1960 used on the railway between Malmo and Limhaum (3 km.). At the turn of the century, when the little railway was built, Limhaum was a fishing village and one of the main reasons for building the railway was the need of transporting the fish to the town. Today Limhaum is part of Malmo and there is no need for a railway. The locomotive with the cylinder between the axles has No. 263 and is built by Nygirst & Holm at Trollhattan in 1888 and the other one has No. 33 and is built by Helsingborgs Mekaniska Verkstad at Helsingborg in 1908.

Malmo, Sweden. L. U. Gunnarsson



End Mills

SIR,—On reading Keith Wilson's article on end mills and lathe tools in *M.E.* 3577, I notice that he recommends a throw-away tip having eight sides. This tip is meant for use with negative top and side rakes, indeed his use of a shim at the back edge of the tip ensures that it does operate in this condition. While agreeing with him that they produce good results in high-powered, heavily-built industrial machines I feel that the loading produced is probably too high for the average model engineer's lathe, even the Myford ML7 or Boxford.

I personally consider that the variety of tip which has four useable edges (or three-sided) and is intended for use with positive rakes may well produce better results on the average small lathe as they require less driving force and also do not tend to be pushed back out of the work so much.

As to regrinding them while some types can be successfully resharpened, others appear to have a shallow hard surface (about .010 in.) and the rest of the tip is comparatively soft and does not hold an edge for long—this is a measure which is only worth trying if no new tips are available.

Alton, Hants. J. H. Whitney

Tobin Bronze Instead of Silver Solder

SIR,—Some time ago I wrote a letter advocating the use of Tobin Bronze instead of silver solder, especially in fabricating work. I received a number of letters asking what was Tobin Bronze? I am afraid I could not help the writers as I did not know myself.

Thanks to Ralph Dunstan of Port Elizabeth, I now have the information. It is the trade name of brazing rod made by The American Brass Company. It is 59% copper, 40.5% zinc and 0.5% tin. Its melting point is 1625°F. Used with Easyflow flux it runs easily and leaves a perfect fillet, ideal for simulating castings.

Johannesburg, South Africa. D. F. Holland

Gauge 1 Loco

SIR,—May I congratulate our Japanese contributors, Nishimura-san and Sato-san, on the second of their excellent reports. I say "reports" advisedly, for that is what to me (a professional technical author) they are. For someone whose native language is so far removed from ours, their clarity and precision is admirable. Furthermore, they supply basic theoretical data; a practice which I would like to see in more articles.

I would hope to see more contributions by these two gentlemen in the future, even if I do have to convert all their (to them, perfectly natural) metrics before they "come alive"!

Arigato, Sato-san; Arigato, Nishimura-san!

Waltham Chase, Southampton. Gordon Read

continued from p 674

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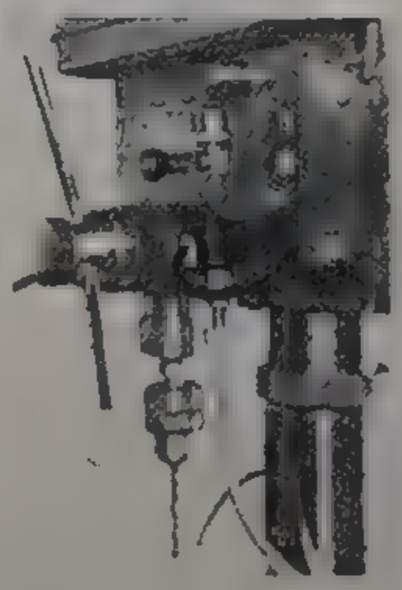

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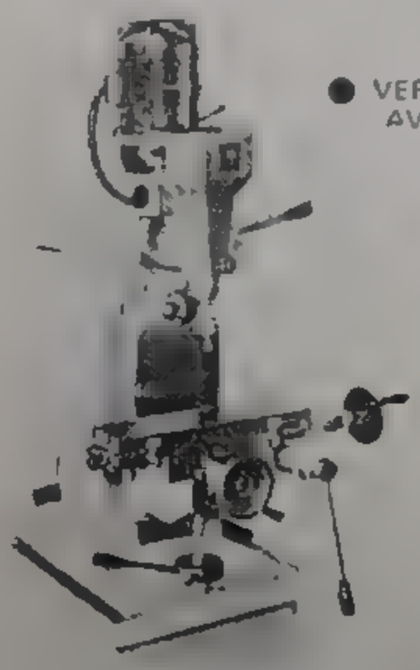

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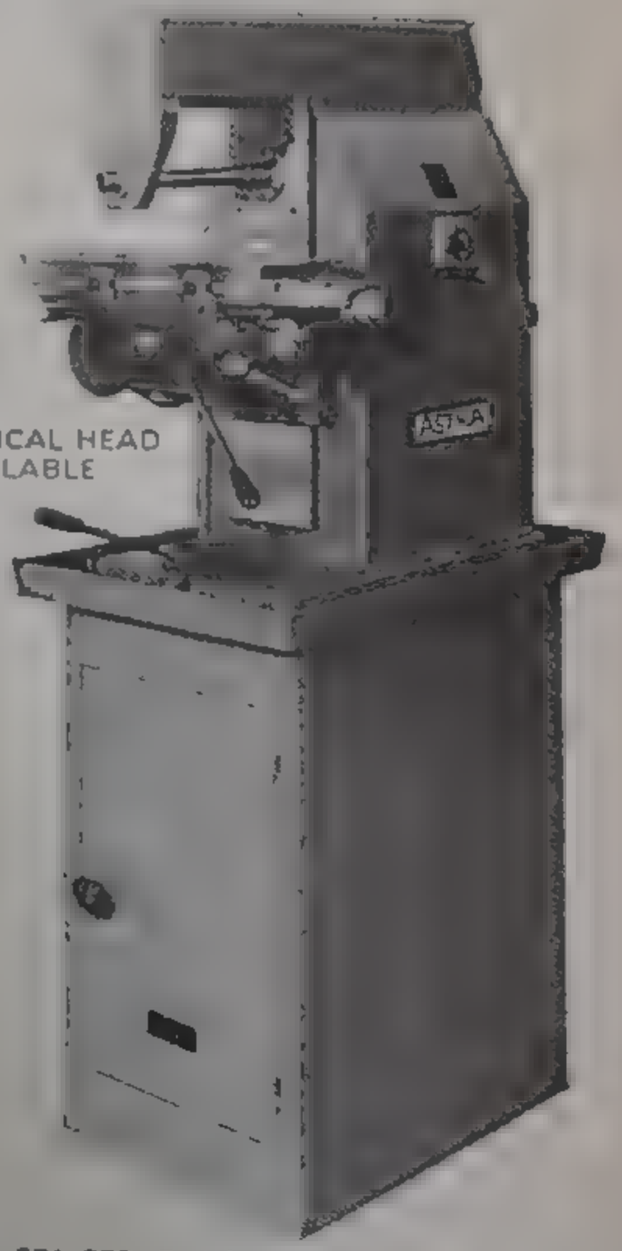

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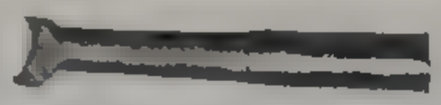

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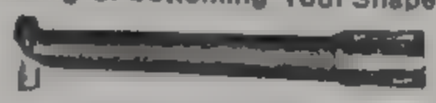

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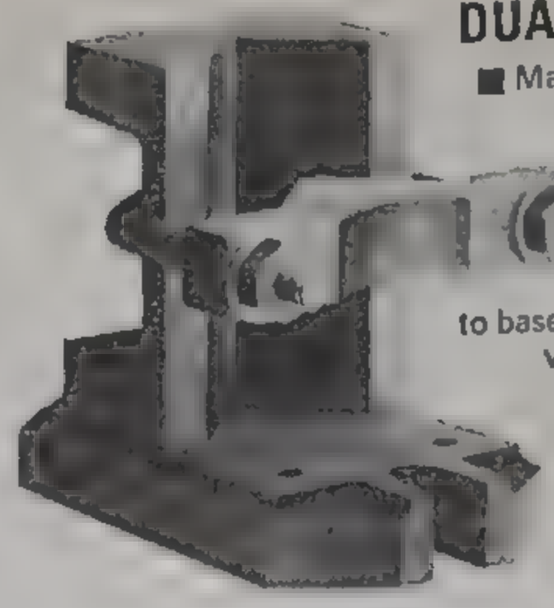

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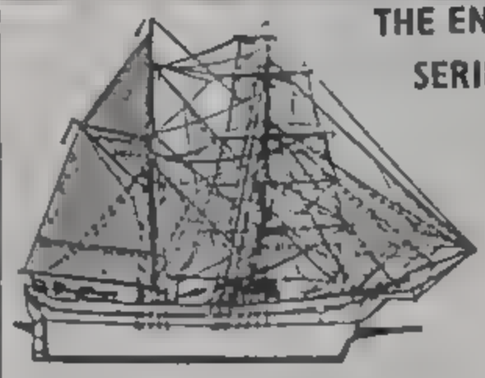

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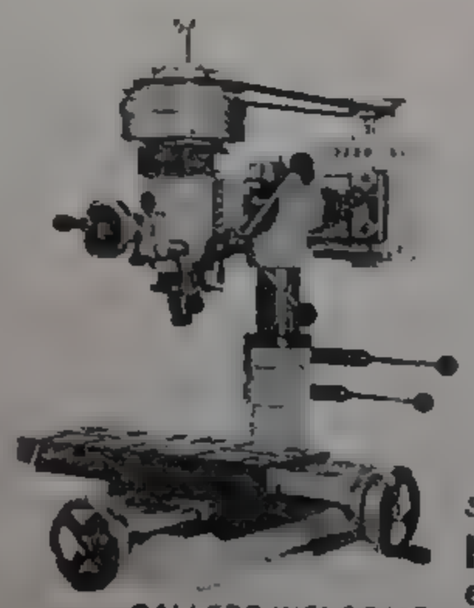

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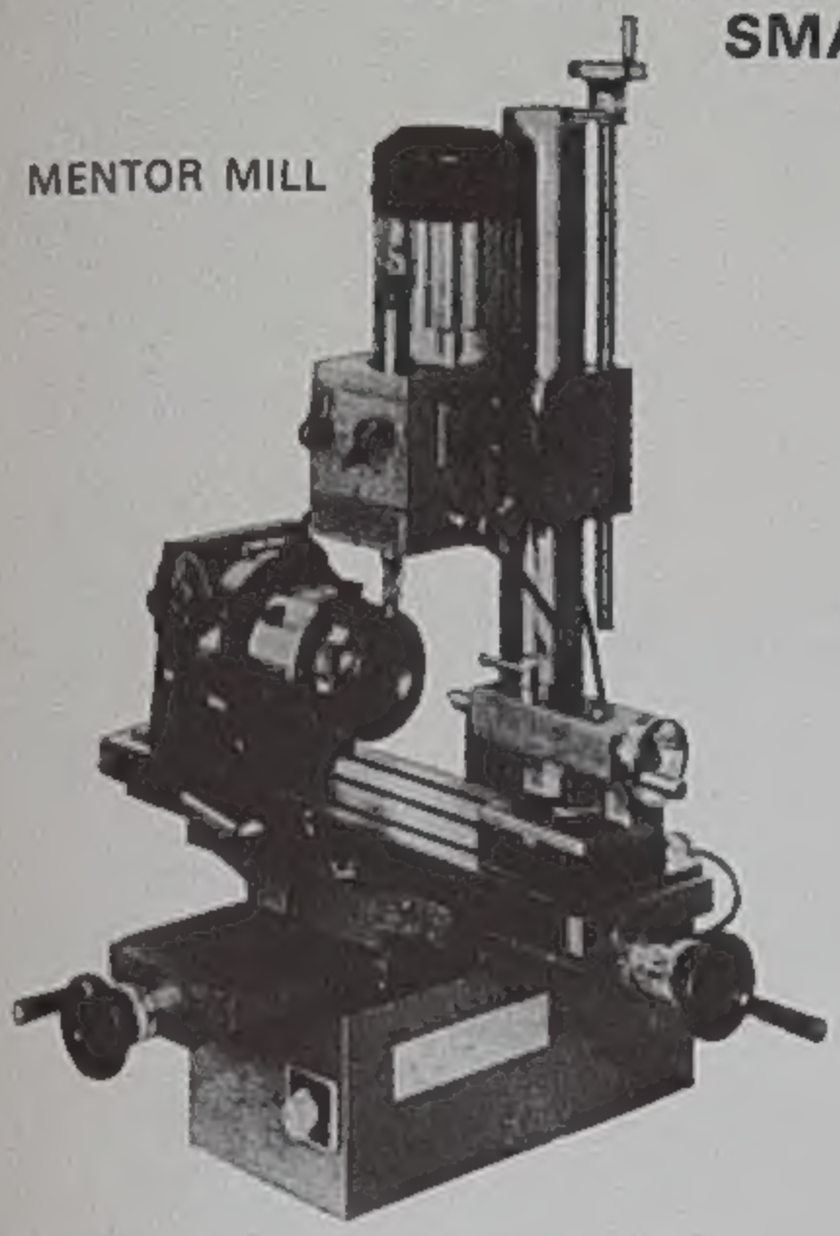

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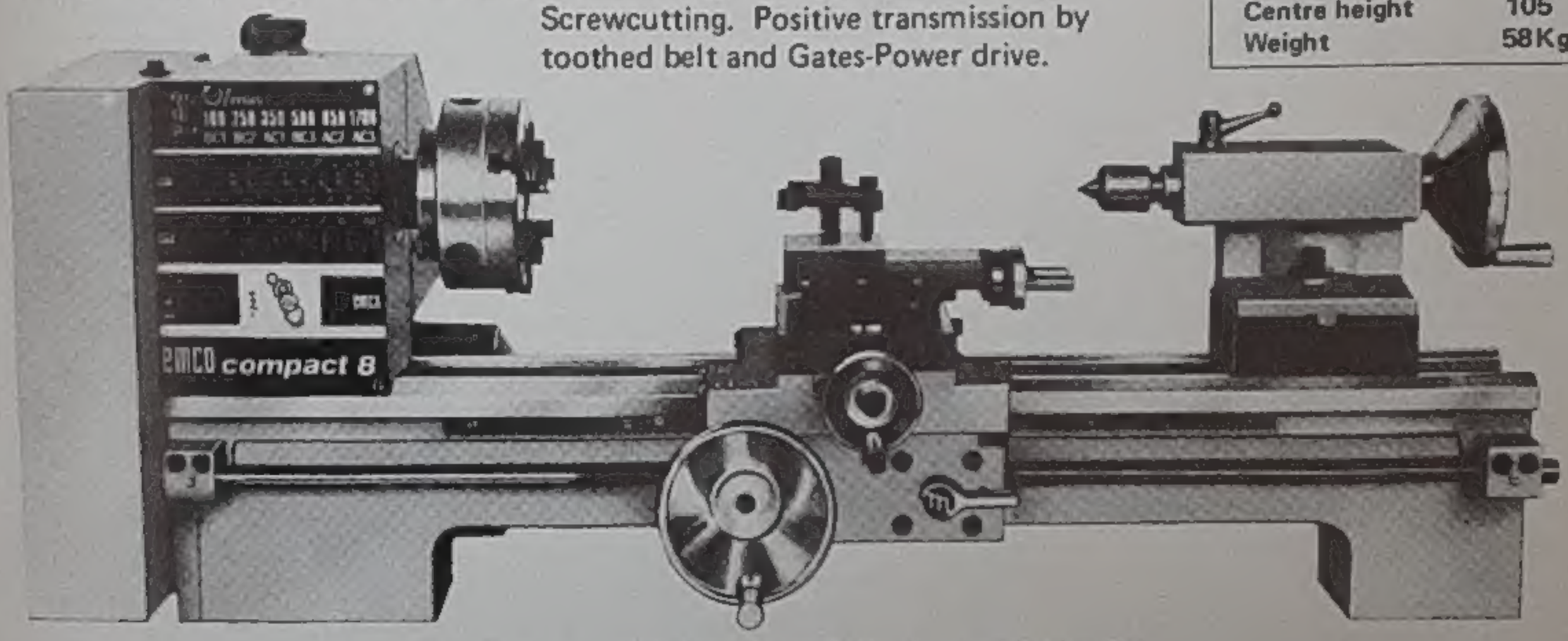

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